

**DRAINAGE CALCULATIONS AND  
STORMWATER MANAGEMENT PLAN**

***For:***

**148 WESTON ROAD  
WELLESLEY, MA**

***Located:***

**140-148 WESTON ROAD  
WELLESLEY, MASSACHUSETTS**

***Submitted to:***

**TOWN OF WELLESLEY**

***Prepared For:***

**WELLESLEY PARK, LLC  
49 COOLIDGE STREET  
BROOKLINE, MASSACHUSETTS 02446**



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**February 28, 2020**

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**Drainage Calculations and Stormwater Management Plan**  
**Municipal Systems Analysis**  
**148 Weston Road**  
**Wellesley, Massachusetts**

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**Project Summary**

The project proponent Wellesley Park, LLC, proposes to redevelop a 1.28-acre parcel of land located at 140-148 Weston Road in Wellesley, Massachusetts. The proposed redevelopment will consist of 26 multi-family residential units. The proposed development will involve the construction of a three (3) story plus one (1) basement level parking building, sidewalks, roof-top courtyard, retaining walls, access drive, stormwater management systems, utilities and other related infrastructure.

The project is comprised of two (2) parcels which is shown as Parcel ID 149-3 and 149-4 on the Town of Wellesley Assessor's Map. The site is bounded by Weston Road to the northeast, developed residential property to the southeast and municipal property owned by the Town of Wellesley to the north and west as shown on Figure 1 - USGS Locus Map.

The project will access the existing utility infrastructure located on Weston Road, including sanitary sewer, water, gas, electric, telephone, and cable television. The stormwater management system will be designed to fully comply with all standards of the Department of Environment Protection's Stormwater Management Regulations and will utilize an on-site subsurface infiltration system for stormwater storage and treatment.

The existing and proposed site conditions are illustrated on the project *site plans* entitled "148 Weston Road", prepared by McKenzie Engineering Group, Inc. dated February 28, 2020.

This report contains stormwater runoff calculations for the pre-development and post-development conditions and includes the sizing of the proposed low impact drainage system and stormwater best management practices (BMPs). All stormwater management facilities will be designed to mitigate peak rates of runoff, provide renovation of stormwater and meet the requirements of the DEP's Stormwater Management Regulations.

**Pre-Development Condition**

The property is located within the General Residence Zoning District and the Residential Incentive Overlay District. The majority of the 1.28 acre-parcel is vacant with one (1) single family home and bituminous driveway and associated landscaping located on Parcel 149-3.

The existing topography generally ranges in elevation from approximately 159 ft. (Wellesley Vertical Datum) in the northeast portion of the site to an elevation of approximately 142 ft. (Wellesley Vertical Datum) in the southeast portion of the site. The parcel slopes from the northeast and southeast property lines, towards a depression in the middle of the site.

Review of available environmental databases such as MassGIS reveals that the site is not located within a mapped Natural Heritage Endangered Species Area, FEMA Flood

Insurance Rate Map Panel No. 25021C0016E (refer to Figure 2 - FEMA Flood Map), or a Contributing Watershed to Outstanding Resource Water (ORW).

The site is located within Wellesley College's Zone II Wellhead Protection Area, (refer to Figure 4 - Wellhead Protection Area Map) and the Town of Wellesley's Water Supply Protection District, (refer to Figure 5 - Wellesley Zoning Map).

The Natural Resources Conservation Service (NRCS) has identified the soil on the site as 254B, Merrimac Fine Sandy Loam, 3 to 8% slopes with hydrologic soil group (HSG) A, and 630C, Charlton-Hollis-Urban land complex, 3 to 15% slopes with hydrologic soil group (HSG) A. Refer to Figure 3 - NRCS Soils Map. Soil testing conducted by McKenzie Engineering Group, Inc. (MEG) on January 31, 2018 identified the soils to be sand, sandy loam and loamy sand. Refer to the soil logs in Appendix C.

The existing watershed analyzed in this report is comprised of approximately 3.158 acres which includes the subject parcel and a portion of offsite tributary areas to the northwest. The watershed consists of one (1) sub-catchment area (1S) and one (1) Design Point (DP-1). Refer to the Pre-Development Watershed Plan WS-1 in Appendix A for a delineation of drainage subcatchments for the pre-development design condition.

The SCS Technical Release 20 (TR-20) and Technical Release 55 (TR-55) method based program "HydroCAD" was employed to develop pre- and post-development peak flows. Drainage calculations were prepared for the pre-development condition for the 2, 10, 25 and 100-year, Type III storm events. Refer to Appendix A for computer results, soil characteristics, cover descriptions and times of concentrations for all subareas.

### **Post-Development Condition**

148 Weston Road is proposed as a 26-unit redevelopment and consists of the construction of a three (3) story plus one (1) basement level parking building, sidewalks, roof-top courtyard, retaining walls, access drive, stormwater management systems, utilities and other related infrastructure.

The project will access the existing utility infrastructure located on Weston Road, including sanitary sewer, water, gas, electric, telephone, and cable television. The stormwater management system will be designed to fully comply with all standards of the Department of Environment Protection's Stormwater Management Regulations and will utilize an on-site subsurface infiltration system for stormwater storage and treatment.

Watershed areas were analyzed in the post-development condition to design low impact stormwater management facilities to mitigate impacts resulting from redeveloping the property. The objective in designing the proposed drainage facilities for the project was to maintain existing drainage patterns to the extent practicable and to ensure that the post-development rates of runoff are less than pre-development rates at the design point. Refer to the Post-Development Watershed Plan WS-2 in Appendix B for a delineation of post-development drainage subareas. The design point for the post-development design conditions correspond to those analyzed for the pre-development design condition.

The subsurface infiltration chamber systems were designed to accommodate peak flow generated by all storms up to the 100-year storm event. All BMPs shall be supported by a comprehensive Construction Phase Pollution Prevention and Erosion Control Plan and Post-Development BMP Operation and Maintenance Plan.

Parking areas will be contained within the building and will drain to oil/sediment traps prior to discharge into the municipal sewer system, as required.

### **Stormwater Detention and Infiltration Facilities**

The proposed stormwater management basin and subsurface infiltration systems were designed to attenuate peak flows generated by all storm events to ensure that post-development peak flows generated by all storm events are less than pre-development flows at the design points and allow for recharge to groundwater. The proposed facilities were analyzed using the Soil Conservation Service (now Natural Resources Conservation Service) Technical Release 20 (TR-20) based computer program, "HydroCAD". The outlet control structures will consist of an outlet structure with an orifice, v-notch or rectangular sharp crested weir to provide 24-hour detention and attenuate the net increase in peak flows. Refer to Appendix B for the HydroCAD computer results for the storage characteristics of the stormwater management facilities.

### **Stormwater Best Management Practices (BMP's)**

The stormwater management system was designed to be in full compliance with the DEP Stormwater Management Policy. A treatment stream consisting of deep-sump catch basins with hooded outlets, proprietary pre-treatment structures and subsurface infiltration chambers (P-1 and P-2) will be employed in the design of drainage facilities for the project to achieve the required removal of 80% total suspended solids. The proposed treatment streams will renovate the stormwater and improve the water quality by promoting the settlement of sediments and pollutants. Refer to the TSS Removal Worksheets in Appendix D for TSS removal rates.

### **Erosion and Siltation Control**

Silt sock erosion control barriers will be placed where indicated on the plans prior to the commencement of any construction activity. The integrity of the silt sock erosion control barrier will be maintained by periodic inspection and replacement as necessary. The silt sock erosion control barrier will remain in place until the first course of pavement has been placed and all side slopes have been loamed and seeded and vegetation has been established. Operation and Maintenance Plans including pollution prevention and erosion and sedimentation controls will be prepared in conjunction with the final construction plans as required by the DEP Stormwater Management Regulations and NPDES.

### **Compliance with Stormwater Management Standards**

#### **Standard 1 – No New Untreated Discharges**

The site development is designed so that new stormwater conveyances do not discharge untreated pavement runoff into, or cause erosion to, wetlands.

#### **Standard 2 – Peak Rate Attenuation**

In the pre-development and post-development stormwater analysis, the watershed area analyzed was approximately 1.28 acres consisting of the subject parcel to be developed and offsite tributary areas. Refer to Existing Watershed Delineation Plan WS-1 for a delineation of drainage subareas for the pre-development design condition and refer to

Post-Development Watershed Delineation Plan WS-2 for a delineation of drainage subareas for the post-development design condition.

Drainage calculations were performed by employing SCS TR-20 methods for the 2, 10, 25, and 100-year Type III storm events. Refer to Appendix A and B for computer results. The stormwater management systems were designed to accommodate peak flows generated by a 100-year storm event.

The peak rates of runoff are as follows:

***Pre-Development vs. Post-Development Peak Rates of Runoff***

Design Point	<u>2 Year Storm (3.20 Inches)</u>		<u>10 Year Storm (4.70 Inches)</u>		<u>25 Year Storm (5.50 Inches)</u>		<u>100 Year Storm (6.70 Inches)</u>	
	Exist. (cfs)	Prop. (cfs)	Exist. (cfs)	Prop. (cfs)	Exist. (cfs)	Prop. (cfs)	Exist. (cfs)	Prop. (cfs)
Design Point 1	0.00	0.000	0.04	0.03	0.12	0.07	0.61	0.31

A comparison of the pre-development and post-development peak rates of runoff indicates that the peak rates of runoff for the post-development condition will be equal or less than the pre-development condition for all storm events.

***Pre-Development vs. Post-Development Volume in ac-ft***

Design Point	<u>2 Year Storm (3.20 Inches)</u>		<u>10 Year Storm (4.70 Inches)</u>		<u>25 Year Storm (5.50 Inches)</u>		<u>100 Year Storm (6.70 Inches)</u>	
	Exist. (ac-ft)	Prop. (ac-ft)	Exist. (ac-ft)	Prop. (ac-ft)	Exist. (ac-ft)	Prop. (ac-ft)	Exist. (ac-ft)	Prop. (ac-ft)
Design Point 1	0.00	0.00	0.024	0.005	0.060	0.009	0.140	0.081

**Standard 3 – Groundwater Recharge**

Runoff will be infiltrated by five (5) subsurface infiltration systems (P-1, P-2, P-3, P-4 & P-5), which will meet the Stormwater Guidelines for infiltration:

- Infiltration structures will be a minimum of two feet above seasonal high groundwater.
- Utilize the “static” method for sizing the storage volume.
- Refer to Appendix D for supplemental BMP calculations and Appendix F for soil testing support data.

### Groundwater Recharge Volume

Infiltration Basin	Soil Type	Target Depth Factor (F) (in)	Total Impervious Area (ac)	Required Recharge Volume (cf) <sup>1</sup>	Provided Recharge Volume (cf) <sup>2</sup>
	A	0.60	0.939	2,045	
P-1 (Subsurface Chambers)					1,113
P-2 (Subsurface Chambers)					2,755
P-3 (Subsurface Chambers)					4,428
P-4 (Subsurface Chambers)					379
P-5 (Subsurface Chambers)					295
				<b>2,045</b>	<b>2,086 ADJ 8,970</b>

1. Required Recharge Volume = Target Depth Factor x Impervious Area / (d+Kt)
2. Provided Recharge Volume = Volume Provided from Bottom of System to lowest outlet invert.

Per Standard 3, if stormwater runoff from less than 100%, but greater than 65% of the sites' impervious cover is directed to the BMP intended to infiltrate the Required Recharge Volume, the storage capacity of the infiltration BMP needs to be increased so that the BMP can capture more of the runoff from the impervious surfaces located within the contributing drainage area. Refer to Appendix D for Capture Area Adjustment calculations.

### Standard 4 – Water Quality

The Long-Term Pollution Prevention Plan has been incorporated into the Post-Development Operation and Maintenance Plan. Refer to Appendix D for BMP Operation and Maintenance Plans. The water quality volume for the site redevelopment is treated by proprietary treatment units - First Defense Units (FD-4HC). MassDEP has adopted a standard method to convert required water quality volume to a discharge rate for sizing flow based manufactured proprietary stormwater treatment practices. The half-inch rule has been applied to the water quality flow rate calculations. Refer to Appendix C for supporting calculations. The water quality treatment flow rate is provided within the storm water management facilities is as follows:

#### *Water Quality Treatment Volume*

	Required	Proposed	
First Defense Unit	WQ Flow Rate (cfs)	WQ Flow Rate (cfs)	
First Defense Unit (FD 1)	0.041	0.70	First Defense Unit - FD-4HC
First Defense Unit (FD-2)	0.086	0.70	First Defense Unit - FD-4HC
First Defense Unit (FD 3)	0.068	0.70	First Defense Unit - FD-4HC
	0.195	2.80	

The stormwater management system was designed to be in full compliance with the DEP Stormwater Management Policy. A treatment stream consisting of deep-sump catch basins with hooded outlets to a subsurface infiltration chamber system or First Defense pre-treatment units will be employed in the design of the drainage facilities for the project to achieve the required removal of 80% total suspended solids to the maximum extent practicable. The proposed treatment streams will renovate the stormwater and improve the water quality by promoting the settlement of sediments and pollutants before runoff is released into down gradient wetlands. Refer to the TSS Removal Worksheets for TSS removal rates and sizing calculations for treatment unit water quality flow rates in Appendix D.

#### Standard 5 – Land Use with Higher Potential Pollutant Loads (LUHPPL)

The proposed project does not include land uses with higher potential pollutant loads. Not Applicable.

#### Standard 6 – Critical Areas

The proposed project does not discharge to any critical areas. Not Applicable.

#### Standard 7 - Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

The proposed project is considered a redevelopment project and as such meets the Stormwater Management Standards to the maximum extent practicable.

#### Standard 8 – Construction Period Pollution Prevention and Erosion and Sedimentation Control

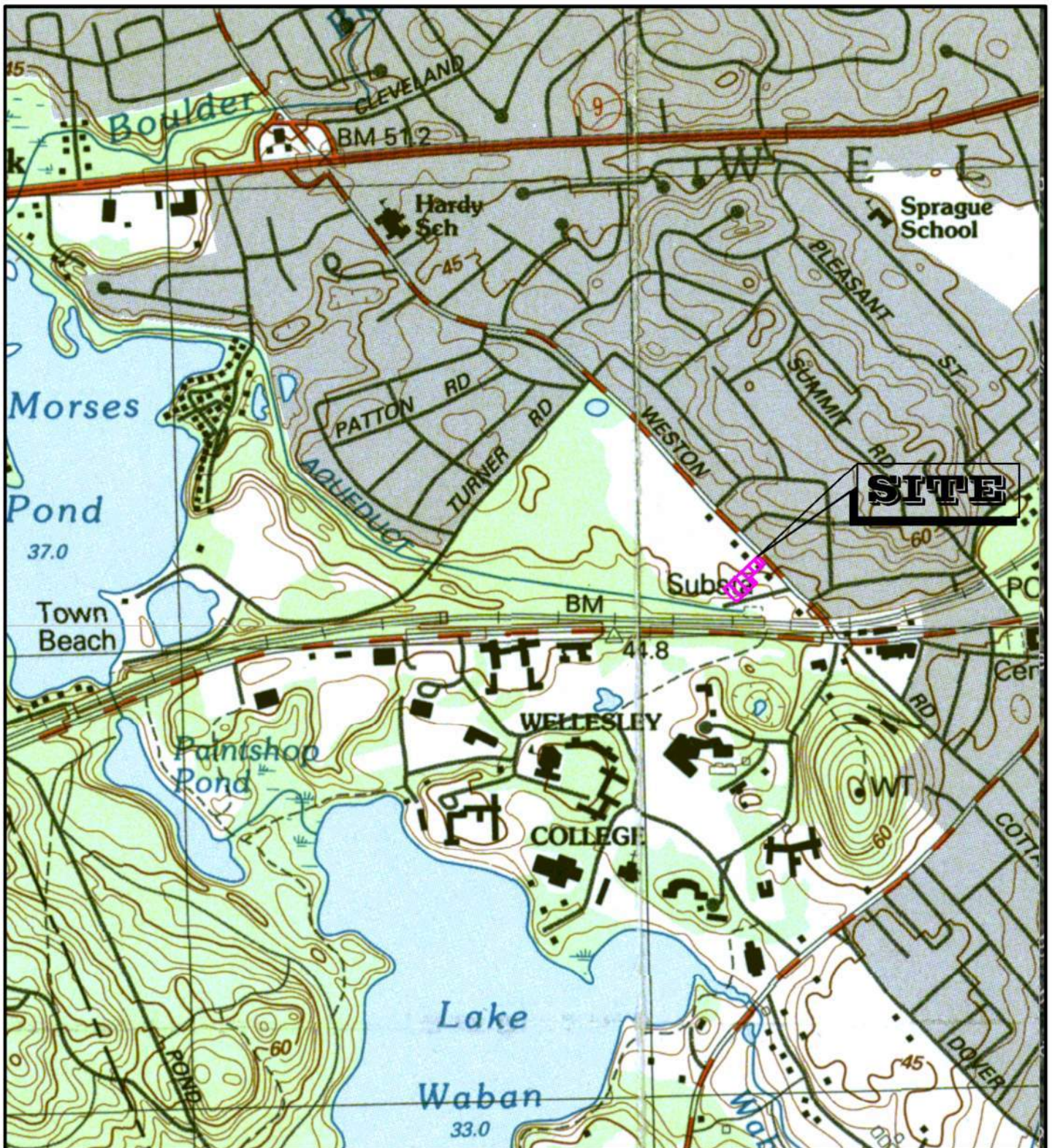
The project will require a NPDES Construction General Permit but the Stormwater Pollution Prevention Plan (SWPPP) has not been submitted. The SWPPP will be submitted prior to any proposed construction. A Construction Phase BMP Operation and Maintenance Plan will be provided as a basis for the SWPPP during final design.

#### Standard 9 – Operation and Maintenance Plan

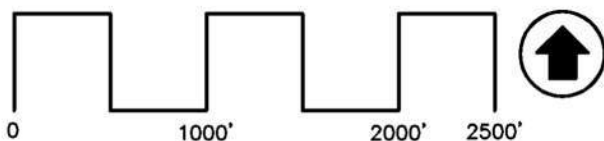
The Long-Term Operation and Maintenance Plan is provided in Appendix E.

#### Standard 10 – Prohibition of Illicit Discharges

No illicit discharges are anticipated on site. An Illicit Discharge Compliance Statement will be submitted prior to the discharge of any stormwater to the post-construction best management practices. Measures to prevent illicit discharges will be included in the Long-Term Pollution Prevention Plan.



**FIGURE - 1**



U.S. GEOLOGICAL SURVEY  
7.5 X 15 MINUTE SERIES



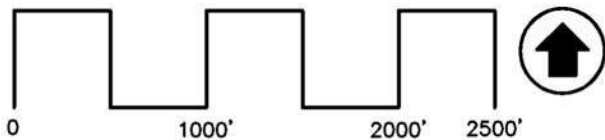
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**USGS LOCUS MAP**

148 WESTON ROAD  
PARCEL 149-4  
WELLESLEY, MASSACHUSETTS



**FIGURE - 2**



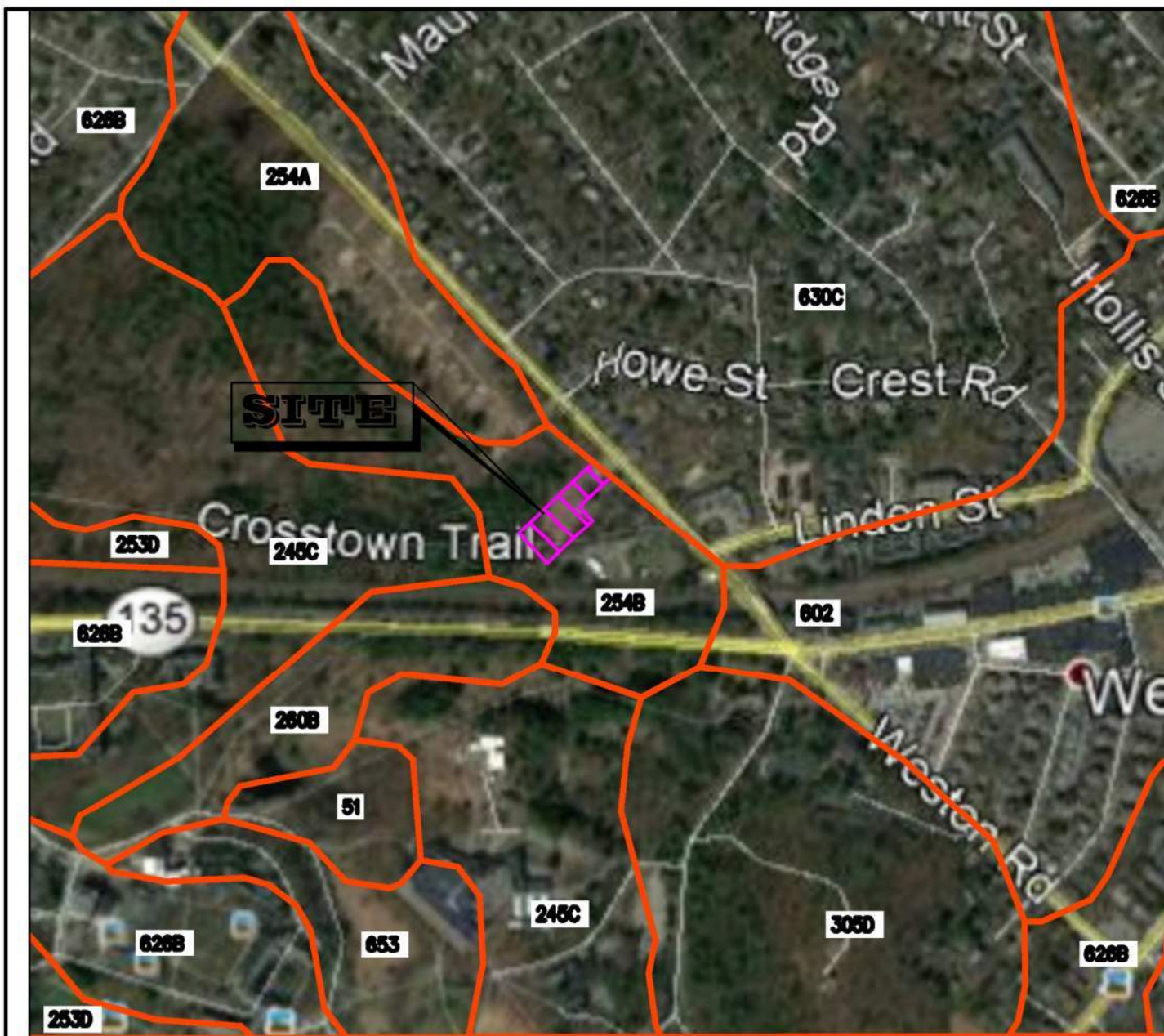
COMMUNITY PANEL NO: 25021C0016E  
 EFFECTIVE DATE: JULY 17, 2012



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## FEMA FLOOD MAP

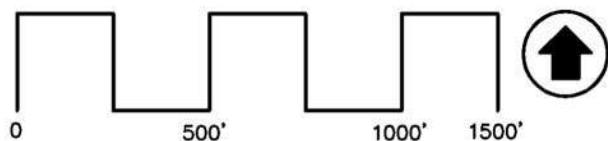
148 WESTON ROAD  
 PARCEL 149-4  
 WELLESLEY, MASSACHUSETTS



### SOIL KEY

SOIL CLASSIFICATION	DESCRIPTION	HYDROLOGIC SOIL GROUP
254B	MERRIMAC FINE SANDY LOAM, 3-8 PERCENT SLOPES	A
630C	CHARLTON-HOLLIS-URBAN LAND COMPLEX, 3-15 PERCENT SLOPES	A

### FIGURE - 3



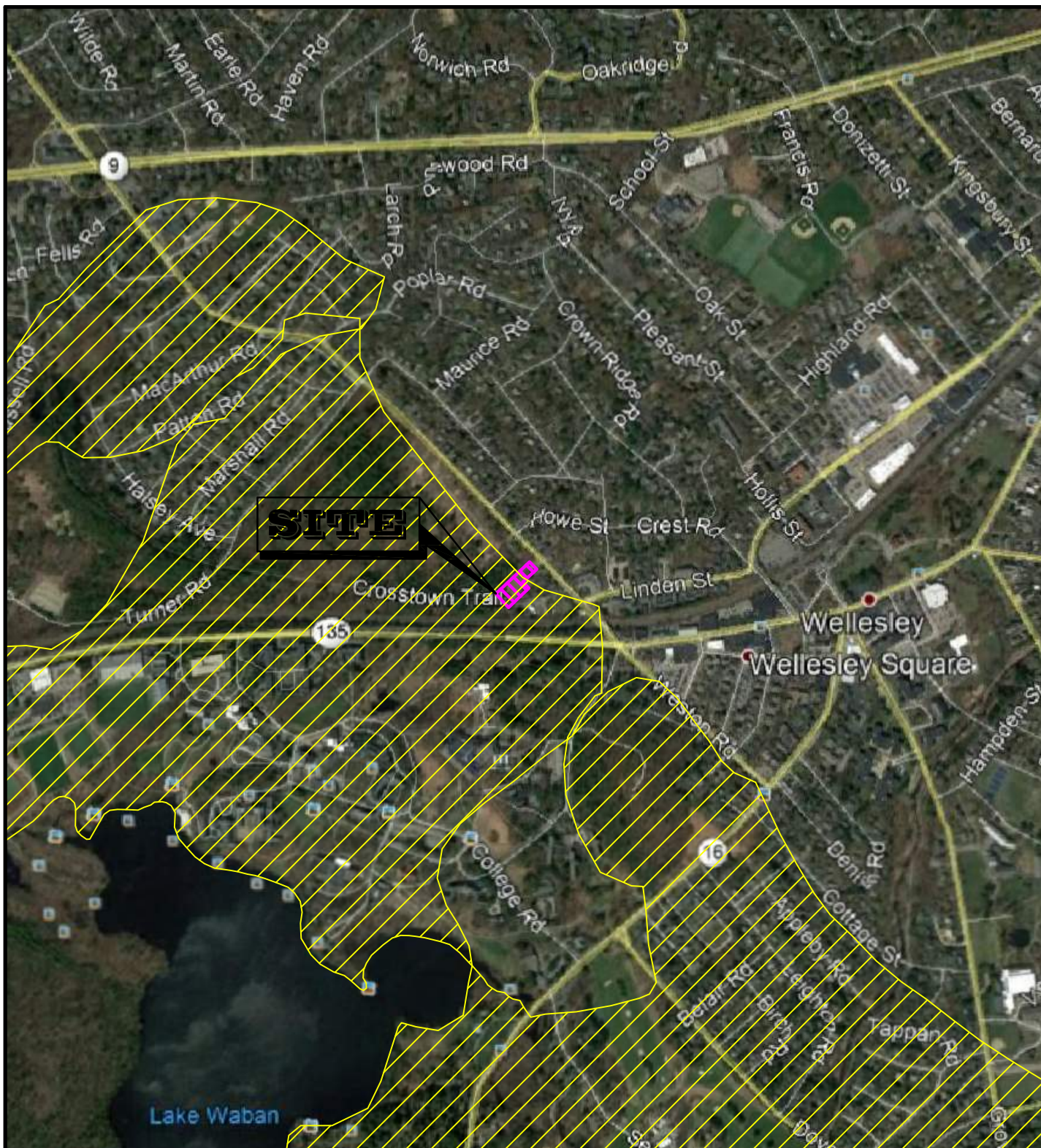
NRCS SOIL SURVEY  
PLYMOUTH COUNTY



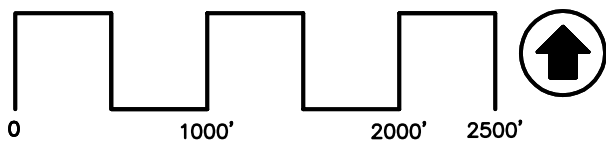
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### NRCS SOILS MAP

148 WESTON ROAD  
PARCEL 149-4  
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**FIGURE - 4**



MASSDEP WELLHEAD PROTECTION  
AREA (ZONE II)

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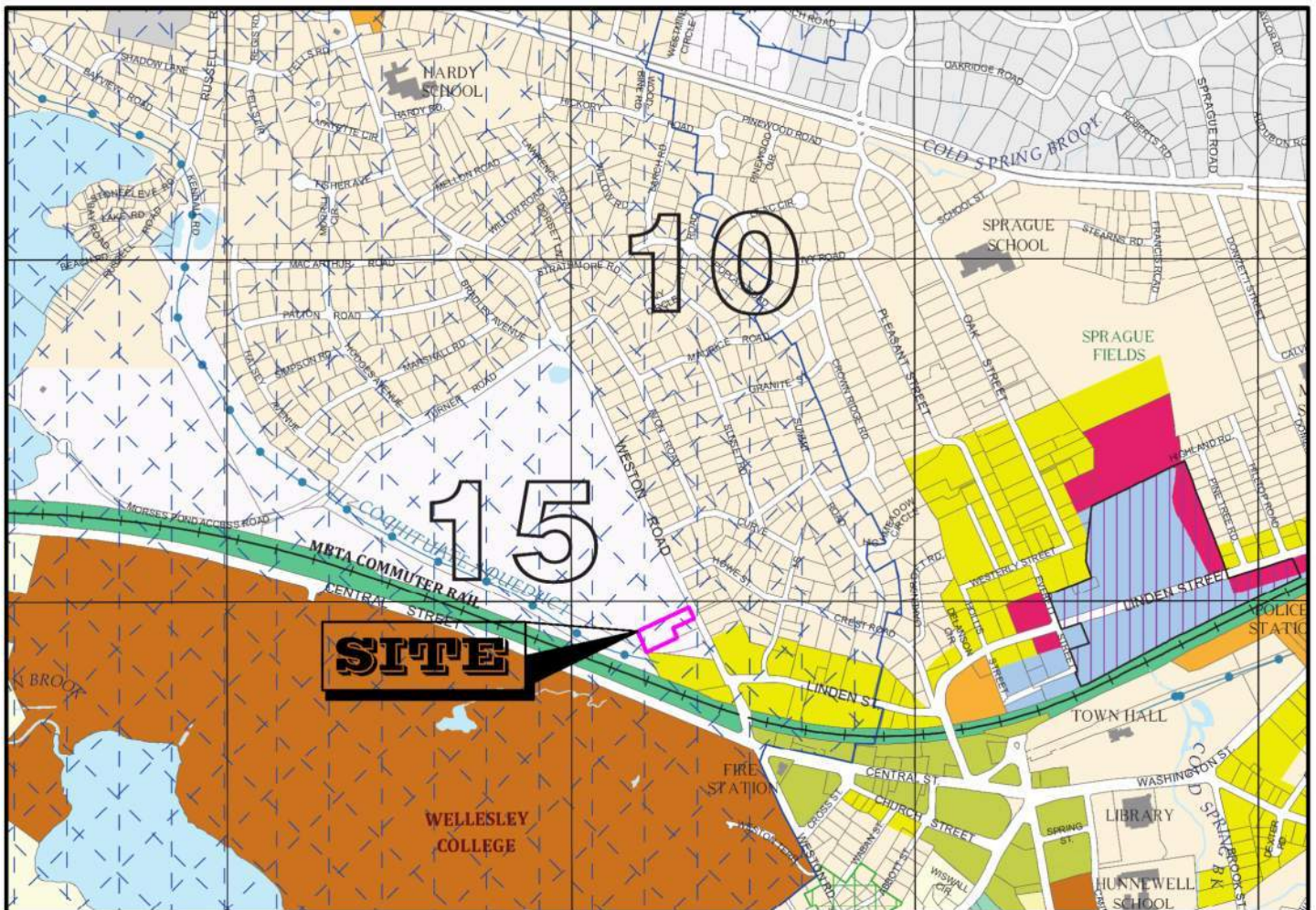
DATE: JANUARY 4, 2018



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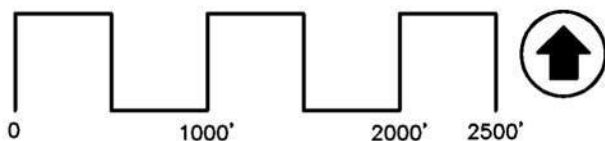
**WELLHEAD PROTECTION AREA  
MAP**

148 WESTON ROAD  
PARCEL 149-4  
WELLESLEY, MASSACHUSETTS



- |                             |   |   |
|-----------------------------|---|---|
| Single Residence A          | Business A                              | Historic District                       |
| Multi-Family Residence      | Industrial                              | Residential Incentive Overlay District  |
| Town House                  | Industrial A                            | Water Supply Protection District        |
| General Residence           | Transportation                          | Linden Street Corridor Overlay District |
| Limited Residence           | Conservation                            |   |
| Limited Apartment           | Lower Falls Village Commercial District |   |
| Educational                 | Wellesley Square Commercial District    |   |
| Educational A               | Single Residence 10                     |   |
| Educational B               | Single Residence 15                     |   |
| Administrative/Professional | Single Residence 20                     |   |
| Limited Business            | Single Residence 30                     |   |
| Business                    | Single Residence 40                     |   |
- Note:  
Refer to flood plain maps and watershed protection maps for adopted flood plain and watershed protection districts.

**FIGURE - 5**



TOWN OF WELLESLEY  
ZONING MAP



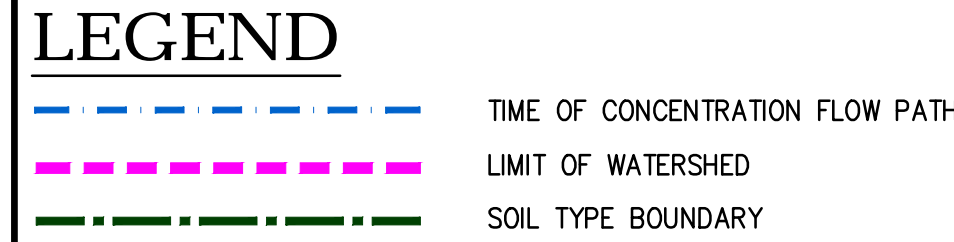
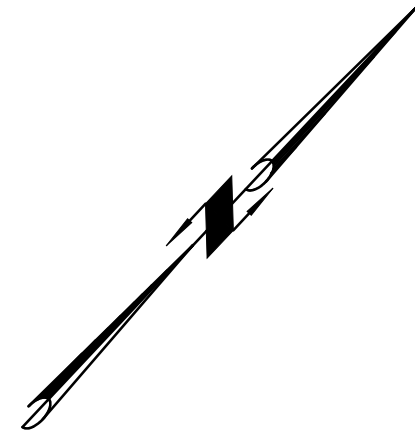
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**WELLESLEY ZONING MAP**

148 WESTON ROAD  
PARCEL 149-4  
WELLESLEY, MASSACHUSETTS

## **A P P E N D I X A**

### **Pre-Development Condition**



SOIL KEY		
SOIL CLASSIFICATION	DESCRIPTION	HYDROLOGIC SOIL GROUP
254A	MERRIMAC FINE SANDY LOAM, 0-3 PERCENT SLOPES	A
254B	MERRIMAC FINE SANDY LOAM, 3-8 PERCENT SLOPES	A
630C	CHARLTON-HOLLIS-URBAN LAND COMPLEX, 3-15 PERCENT SLOPES	A

## ABBREVIATIONS





















FFE	FIRST FLOOR ELEVATION
BIT CONC.	BITUMINOUS CONCRETE PAVEMENT
CCB	CAGE COD BERM
EDP	EDGE OF PAVEMENT
CB	BITUMINOUS CONCRETE CURB
(AM)	AS MEASURED
RET WALL	RETAINING WALL
CONC.	CONCRETE
RCP	REINFORCED CONCRETE PIPE
VCL	VERTICAL GRANITE CURB
EDGE OF TRW	EDGE OF TRAVEL WAY
MTC	METAL BERM
VCC	VERTICAL CONCRETE CURB
CMP	CORRUGATED METAL PIPE
TOW	TOP OF WALL
SGC	SLOPED GRANITE CURB







## LEGEND

## SURVEY SYMBOL














- |                                |                                |
|--------------------------------|--------------------------------|
| •                              | REBAR                          |
| ✓                              | ANGLE IRON                     |
| CB/DH <input type="checkbox"/> | CONCRETE BOUND WITH DRILL HOLE |
| SB <input type="checkbox"/>    | STONE BOUND                    |
| SB/DH <input type="checkbox"/> | STONE BOUND                    |

## UTILITY SYMBOLS

- |   |                            |
|---|----------------------------|
|  | CHIMNEY                    |
|  | ELECTRIC HAND HOLE         |
|  | GUY POLE                   |
|  | GUY WIRE                   |
|  | HVAC UNIT                  |
|  | BUILDING LIGHT W/MAST      |
|  | TRANSFORMER                |
|  | WATER GATE                 |
|  | EXH ● EXHAUST VENT         |
|  | ● DRAINAGE SUMP            |
|  | ○ EMH ELECTRIC MANHOLE     |
|  | ○ DMH SEWER MANHOLE        |
|  | ○ SMH DRAIN MANHOLE        |
|  | ○ TBM TELEPHONE MANHOLE    |
|  | □ CBN DRAINAGE CATCH BASIN |
|  | — DOOR WAY THRESHOLD       |
|  | ○ HYDRANT                  |
|  | ○ POST INDICATOR VALVE     |
|  | ○ UTILITY POLE             |
|  | ○ YARD LIGHT               |

- |   |                 |
|---|-----------------|
|  | RIP RAP         |
|  | BOLLARD         |
|  | SIGN            |
|  | FIRE ALARM      |
|  | DECIDUOUS TREE  |
|  | CONIFEROUS TREE |

## LINE DESIGNATORS

- |   |                      |
|---|----------------------|
|  | WATER MAIN           |
|  | HANDRAIL             |
|  | JERSEY BARRIER       |
|  | GUARD RAIL           |
|  | RAILROAD TRACKS      |
|  | OVERHEAD WIRES       |
|  | GAS LINE             |
|  | WATER SERVICE        |
|  | UNDERGROUND ELECTRIC |
|  | STORM DRAIN LINE     |
|  | SANITARY SEWER LINE  |
|  | DRAINAGE SWALE       |
|  | CHAIN LINK FENCE     |

[illegible]

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148 WESTON ROAD

(PARCEL IDS 149-A, 149-1, 149-3, & 149-4)  
140-148 WESTON ROAD  
WELLESLEY, MASSACHUSETTS

PROFESSIONAL ENGINEER:

**PPLICANT:**  
**WELLESLEY PARK LLC,**  
**49 COOLIDGE STREET**  
**BROOKLINE, MASSACHUSETTS 02446**

NOT FOR CONSTRUCTION

DRAWN BY:	SBS
DESIGNED BY:	SBS
CHECKED BY:	BCM
APPROVED BY:	BCM
DATE:	FEBRUARY 28, 2020
SCALE:	1"=30'
PROJECT NO.:	217-177
DWG. TITLE:	

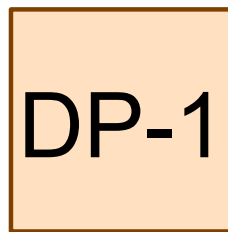
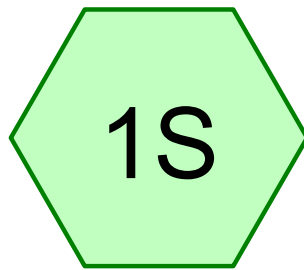
PRE-DEV.  
WATERSHED  
PLAN

DWG. NO:

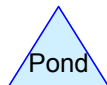
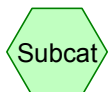
# WS-1

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M:\MEG\2017 PROJECTS\217-177 (OAKGROVE- WESTON ROAD WELLESLEY)\DWGS\SUBMISSIONS\PSI\217-177 WATERSHED  
PSI.DWG



PROPERTY LINE



## 217-177 Pre Development PSI

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Page 2

### Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.075	39	>75% Grass cover, Good, HSG A (1S)
0.357	39	>75% Grass cover, Good, HSG A (offsite) (1S)
0.018	96	Gravel surface, HSG A (1S)
0.116	96	Gravel surface, HSG A (offsite) (1S)
0.008	98	Paved parking, HSG A (1S)
0.014	98	Paved parking, HSG A (offsite) (1S)
0.040	98	Roofs, HSG A (1S)
0.086	98	Roofs, HSG A (offsite) (1S)
0.953	30	Woods, Good, HSG A (1S)
1.474	30	Woods, Good, HSG A (offsite) (1S)
<b>3.141</b>	<b>37</b>	<b>TOTAL AREA</b>

## 217-177 Pre Development PSI

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### Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
3.141	HSG A	1S
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
<b>3.141</b>		<b>TOTAL AREA</b>

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### Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.433	0.000	0.000	0.000	0.000	0.433	>75% Grass cover, Good	1S
0.134	0.000	0.000	0.000	0.000	0.134	Gravel surface	1S
0.022	0.000	0.000	0.000	0.000	0.022	Paved parking	1S
0.126	0.000	0.000	0.000	0.000	0.126	Roofs	1S
2.427	0.000	0.000	0.000	0.000	2.427	Woods, Good	1S
<b>3.141</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>3.141</b>	<b>TOTAL AREA</b>	

## 217-177 Pre Development PSI

Type III 24-hr 2-Year Rainfall=3.20"

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Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

### Subcatchment1S: 1S

Runoff Area=136,835 sf 4.70% Impervious Runoff Depth=0.00"  
Flow Length=724' Tc=18.3 min CN=37 Runoff=0.00 cfs 0.000 af

### Reach DP-1: PROPERTYLINE

Inflow=0.00 cfs 0.000 af  
Outflow=0.00 cfs 0.000 af

**Total Runoff Area = 3.141 ac Runoff Volume = 0.000 af Average Runoff Depth = 0.00"**  
**95.30% Pervious = 2.994 ac 4.70% Impervious = 0.148 ac**

**217-177 Pre Development PSI**

Type III 24-hr 2-Year Rainfall=3.20"

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**Summary for Subcatchment 1S: 1S**

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

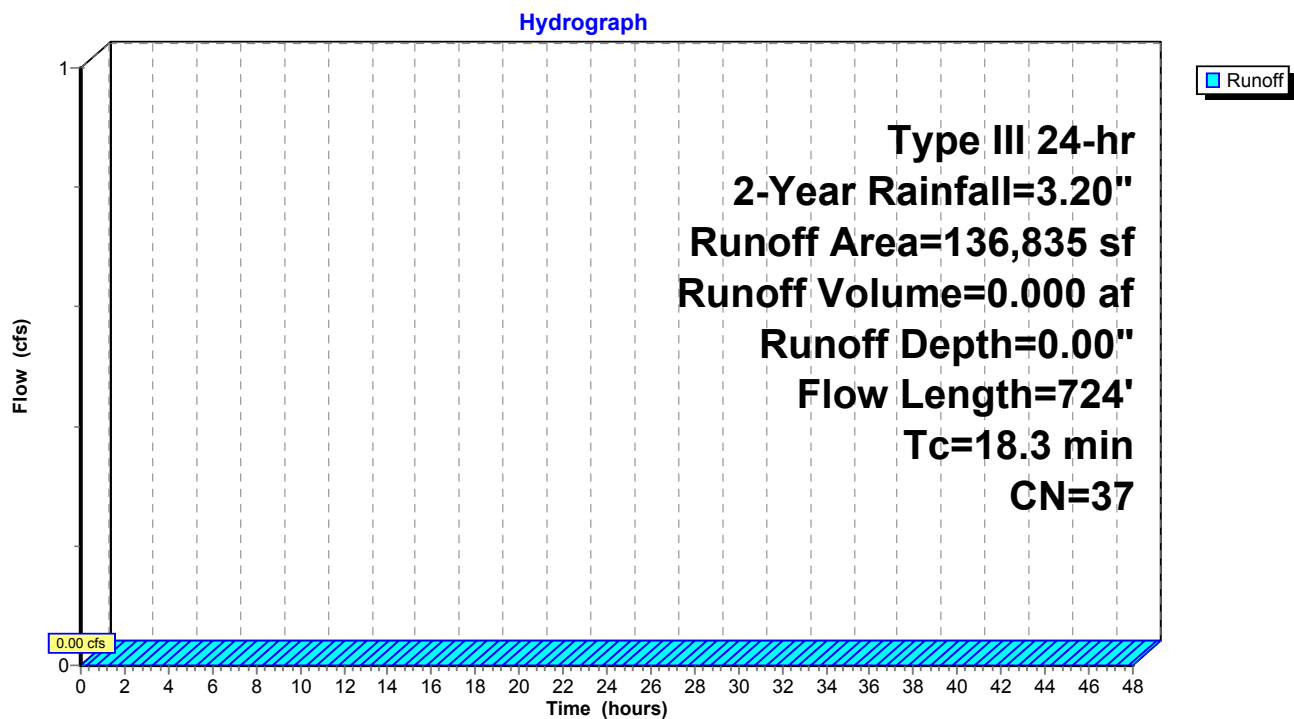
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
* 64,212	30	Woods, Good, HSG A (offsite)
* 5,064	96	Gravel surface, HSG A (offsite)
* 15,561	39	>75% Grass cover, Good, HSG A (offsite)
* 3,726	98	Roofs, HSG A (offsite)
* 623	98	Paved parking, HSG A (offsite)
780	96	Gravel surface, HSG A
1,742	98	Roofs, HSG A
338	98	Paved parking, HSG A
3,284	39	>75% Grass cover, Good, HSG A
41,505	30	Woods, Good, HSG A
136,835	37	Weighted Average
130,406		95.30% Pervious Area
6,429		4.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	50	0.0150	0.06		<b>Sheet Flow, SHEET FLOW</b>
					Woods: Light underbrush n= 0.400 P2= 3.20"
4.5	674	0.0236	2.47		<b>Shallow Concentrated Flow, SHALLOW CONC. FLOW</b>
					Unpaved Kv= 16.1 fps
18.3	724	Total			

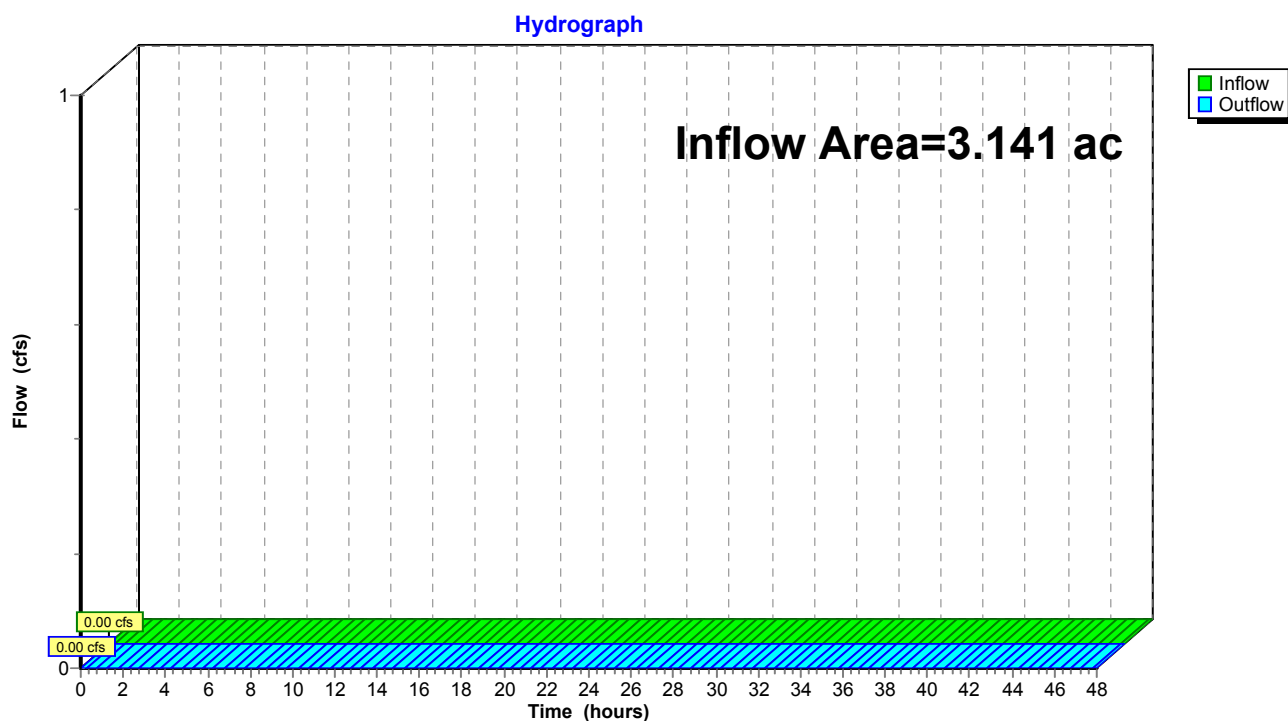
# Subcatchment 1S: 1S



**Summary for Reach DP-1: PROPERTY LINE**

Inflow Area = 3.141 ac, 4.70% Impervious, Inflow Depth = 0.00" for 2-Year event  
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

**Reach DP-1: PROPERTY LINE**

## 217-177 Pre Development PSI

Type III 24-hr 10-Year Rainfall=4.70"

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Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

### Subcatchment1S: 1S

Runoff Area=136,835 sf 4.70% Impervious Runoff Depth=0.09"  
Flow Length=724' Tc=18.3 min CN=37 Runoff=0.04 cfs 0.024 af

### Reach DP-1: PROPERTYLINE

Inflow=0.04 cfs 0.024 af  
Outflow=0.04 cfs 0.024 af

**Total Runoff Area = 3.141 ac Runoff Volume = 0.024 af Average Runoff Depth = 0.09"**  
**95.30% Pervious = 2.994 ac 4.70% Impervious = 0.148 ac**

**217-177 Pre Development PSI**

Type III 24-hr 10-Year Rainfall=4.70"

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**Summary for Subcatchment 1S: 1S**

Runoff = 0.04 cfs @ 15.17 hrs, Volume= 0.024 af, Depth= 0.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-Year Rainfall=4.70"

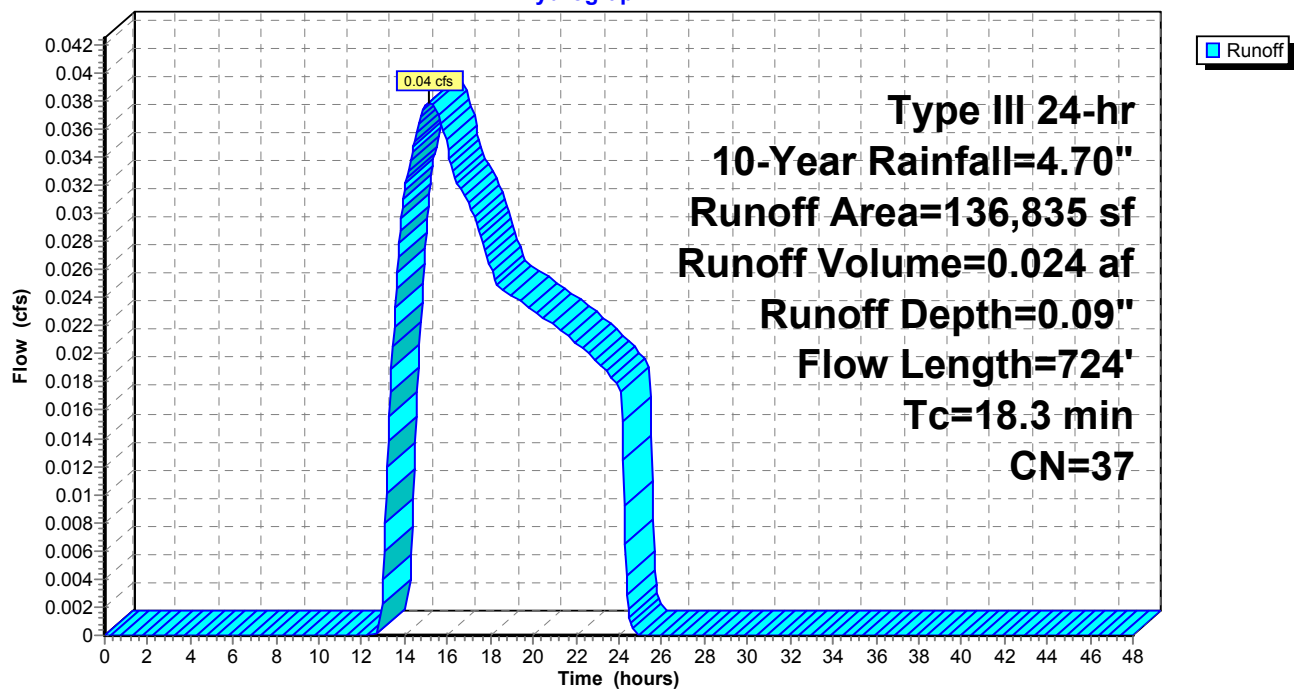
	Area (sf)	CN	Description
*	64,212	30	Woods, Good, HSG A (offsite)
*	5,064	96	Gravel surface, HSG A (offsite)
*	15,561	39	>75% Grass cover, Good, HSG A (offsite)
*	3,726	98	Roofs, HSG A (offsite)
*	623	98	Paved parking, HSG A (offsite)
	780	96	Gravel surface, HSG A
	1,742	98	Roofs, HSG A
	338	98	Paved parking, HSG A
	3,284	39	>75% Grass cover, Good, HSG A
	41,505	30	Woods, Good, HSG A
	136,835	37	Weighted Average
	130,406		95.30% Pervious Area
	6,429		4.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	50	0.0150	0.06		<b>Sheet Flow, SHEET FLOW</b>
					Woods: Light underbrush n= 0.400 P2= 3.20"
4.5	674	0.0236	2.47		<b>Shallow Concentrated Flow, SHALLOW CONC. FLOW</b>
					Unpaved Kv= 16.1 fps
18.3	724	Total			

## Subcatchment 1S: 1S

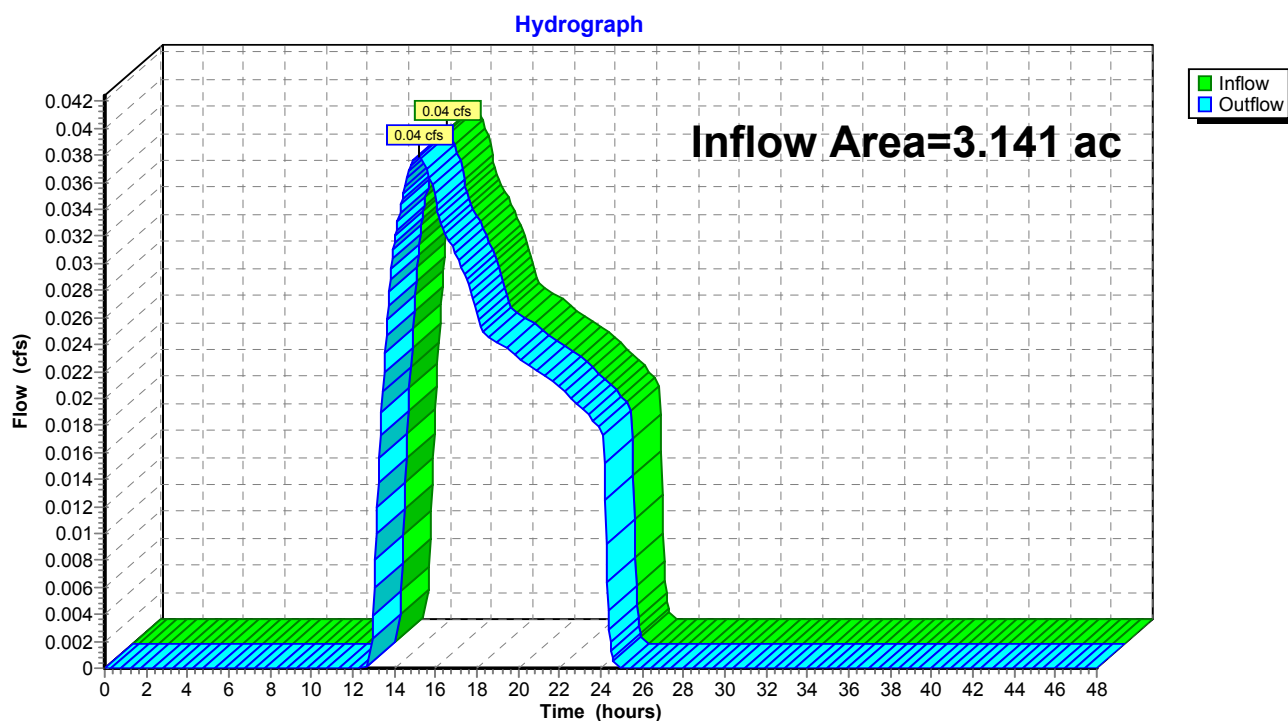
Hydrograph



**Summary for Reach DP-1: PROPERTY LINE**

Inflow Area = 3.141 ac, 4.70% Impervious, Inflow Depth = 0.09" for 10-Year event  
Inflow = 0.04 cfs @ 15.17 hrs, Volume= 0.024 af  
Outflow = 0.04 cfs @ 15.17 hrs, Volume= 0.024 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

**Reach DP-1: PROPERTY LINE**

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Type III 24-hr 25-Year Rainfall=5.50"

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Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

### Subcatchment1S: 1S

Runoff Area=136,835 sf 4.70% Impervious Runoff Depth=0.23"  
Flow Length=724' Tc=18.3 min CN=37 Runoff=0.12 cfs 0.060 af

### Reach DP-1: PROPERTYLINE

Inflow=0.12 cfs 0.060 af  
Outflow=0.12 cfs 0.060 af

**Total Runoff Area = 3.141 ac Runoff Volume = 0.060 af Average Runoff Depth = 0.23"**  
**95.30% Pervious = 2.994 ac 4.70% Impervious = 0.148 ac**

**217-177 Pre Development PSI**

Type III 24-hr 25-Year Rainfall=5.50"

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**Summary for Subcatchment 1S: 1S**

Runoff = 0.12 cfs @ 12.69 hrs, Volume= 0.060 af, Depth= 0.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
* 64,212	30	Woods, Good, HSG A (offsite)
* 5,064	96	Gravel surface, HSG A (offsite)
* 15,561	39	>75% Grass cover, Good, HSG A (offsite)
* 3,726	98	Roofs, HSG A (offsite)
* 623	98	Paved parking, HSG A (offsite)
780	96	Gravel surface, HSG A
1,742	98	Roofs, HSG A
338	98	Paved parking, HSG A
3,284	39	>75% Grass cover, Good, HSG A
41,505	30	Woods, Good, HSG A
136,835	37	Weighted Average
130,406		95.30% Pervious Area
6,429		4.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	50	0.0150	0.06		<b>Sheet Flow, SHEET FLOW</b>
					Woods: Light underbrush n= 0.400 P2= 3.20"
4.5	674	0.0236	2.47		<b>Shallow Concentrated Flow, SHALLOW CONC. FLOW</b>
					Unpaved Kv= 16.1 fps
18.3	724	Total			

## 217-177 Pre Development PSI

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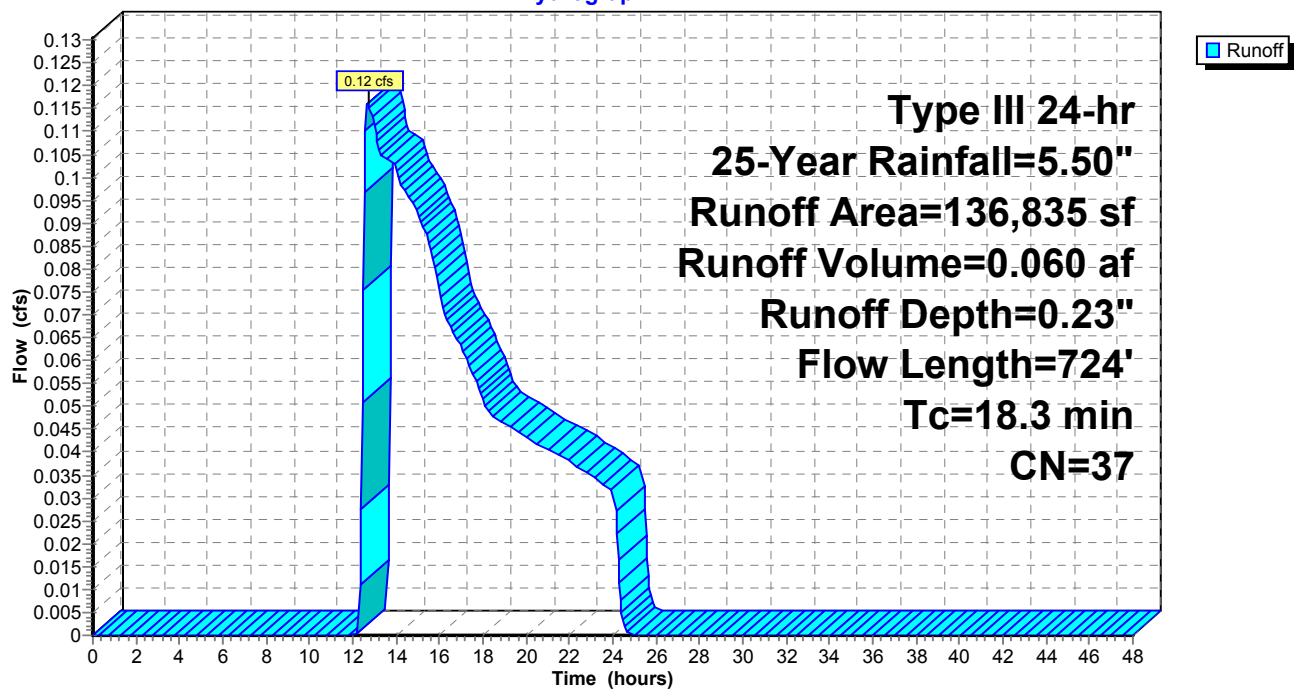
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Type III 24-hr 25-Year Rainfall=5.50"

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### Subcatchment 1S: 1S

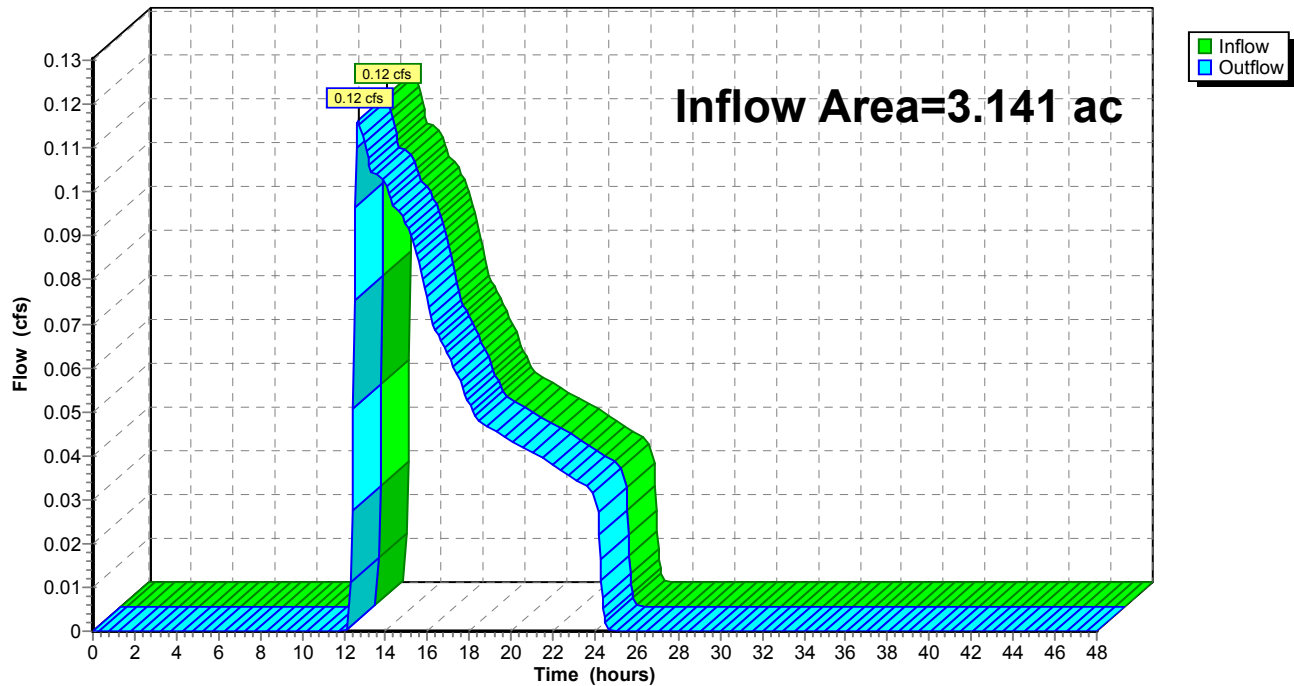
Hydrograph



**Summary for Reach DP-1: PROPERTY LINE**

Inflow Area = 3.141 ac, 4.70% Impervious, Inflow Depth = 0.23" for 25-Year event  
Inflow = 0.12 cfs @ 12.69 hrs, Volume= 0.060 af  
Outflow = 0.12 cfs @ 12.69 hrs, Volume= 0.060 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

**Reach DP-1: PROPERTY LINE****Hydrograph**

## 217-177 Pre Development PSI

Type III 24-hr 100-Year Rainfall=6.70"

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Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

### Subcatchment1S: 1S

Runoff Area=136,835 sf 4.70% Impervious Runoff Depth=0.53"  
Flow Length=724' Tc=18.3 min CN=37 Runoff=0.61 cfs 0.140 af

### Reach DP-1: PROPERTYLINE

Inflow=0.61 cfs 0.140 af  
Outflow=0.61 cfs 0.140 af

**Total Runoff Area = 3.141 ac Runoff Volume = 0.140 af Average Runoff Depth = 0.53"**  
**95.30% Pervious = 2.994 ac 4.70% Impervious = 0.148 ac**

**217-177 Pre Development PSI**

Type III 24-hr 100-Year Rainfall=6.70"

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**Summary for Subcatchment 1S: 1S**

Runoff = 0.61 cfs @ 12.52 hrs, Volume= 0.140 af, Depth= 0.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-Year Rainfall=6.70"

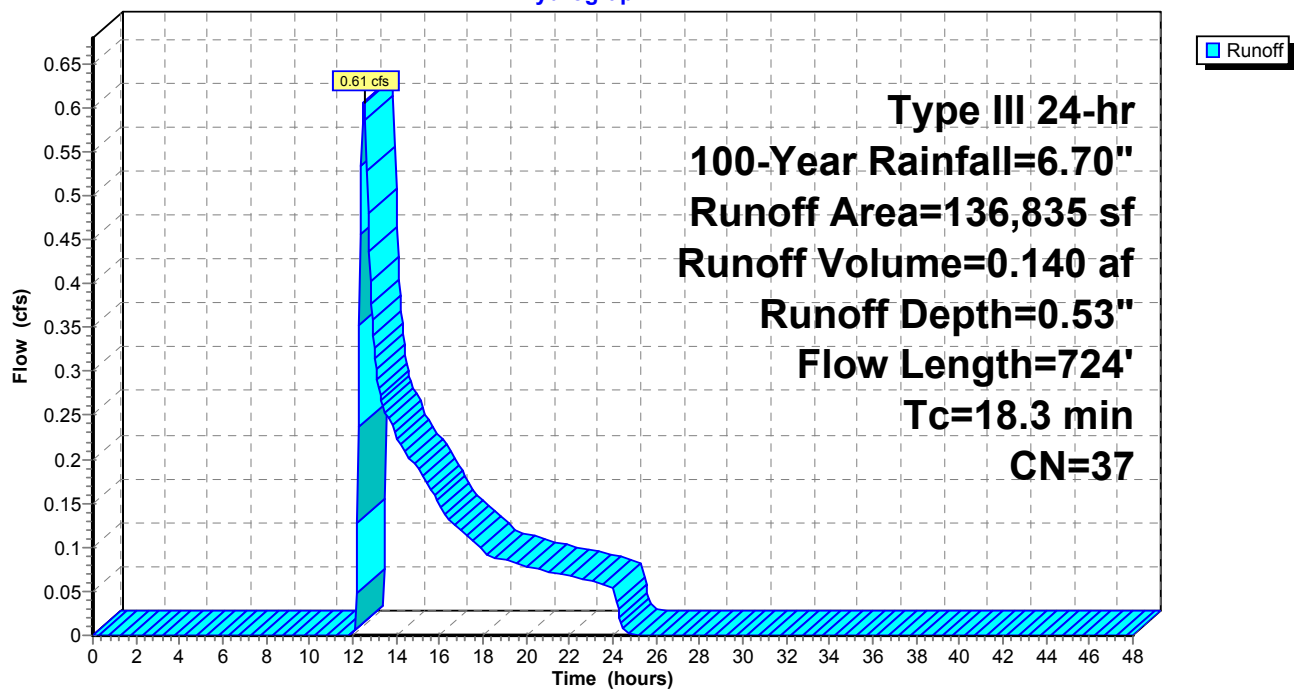
	Area (sf)	CN	Description
*	64,212	30	Woods, Good, HSG A (offsite)
*	5,064	96	Gravel surface, HSG A (offsite)
*	15,561	39	>75% Grass cover, Good, HSG A (offsite)
*	3,726	98	Roofs, HSG A (offsite)
*	623	98	Paved parking, HSG A (offsite)
	780	96	Gravel surface, HSG A
	1,742	98	Roofs, HSG A
	338	98	Paved parking, HSG A
	3,284	39	>75% Grass cover, Good, HSG A
	41,505	30	Woods, Good, HSG A
	136,835	37	Weighted Average
	130,406		95.30% Pervious Area
	6,429		4.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	50	0.0150	0.06		<b>Sheet Flow, SHEET FLOW</b>
					Woods: Light underbrush n= 0.400 P2= 3.20"
4.5	674	0.0236	2.47		<b>Shallow Concentrated Flow, SHALLOW CONC. FLOW</b>
					Unpaved Kv= 16.1 fps
18.3	724	Total			

Subcatchment 1S: 1S

Hydrograph



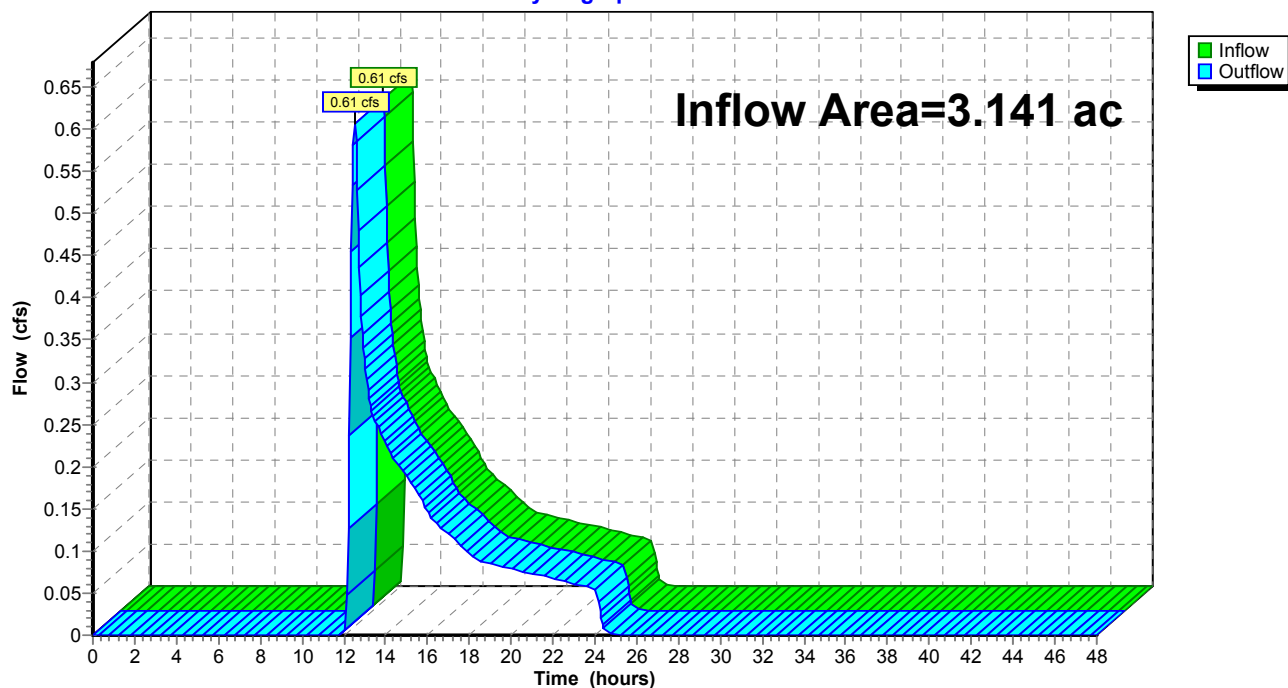
**Summary for Reach DP-1: PROPERTY LINE**

Inflow Area = 3.141 ac, 4.70% Impervious, Inflow Depth = 0.53" for 100-Year event  
Inflow = 0.61 cfs @ 12.52 hrs, Volume= 0.140 af  
Outflow = 0.61 cfs @ 12.52 hrs, Volume= 0.140 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

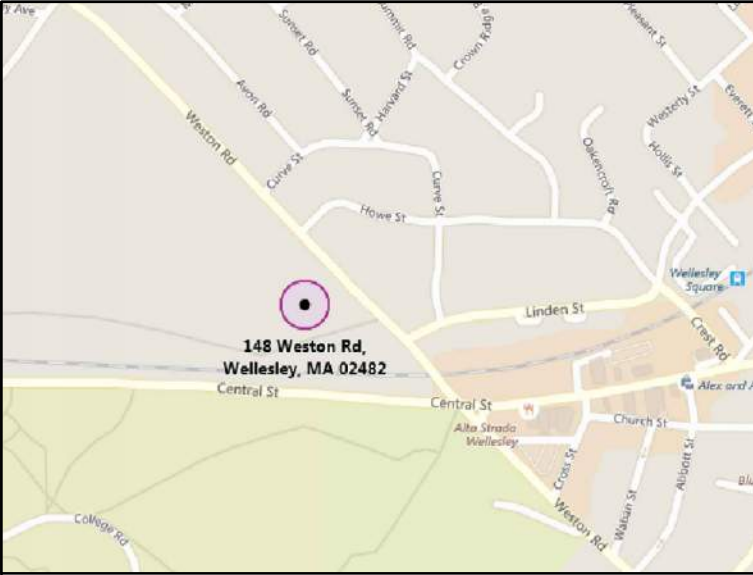
**Reach DP-1: PROPERTY LINE**

Hydrograph

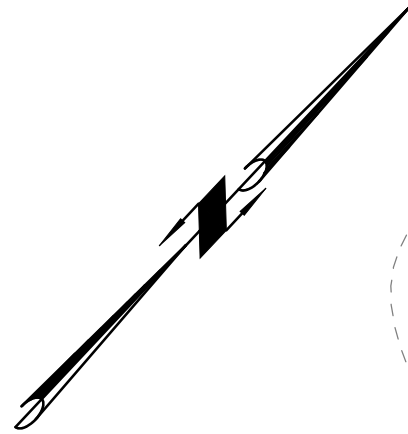


## **A P P E N D I X B**

### **Post-Development Condition**



LOCUS MAP  
Not to Scale



LEGEND

- TIME OF CONCENTRATION FLOW PATH
- LIMIT OF WATERSHED
- SOIL TYPE BOUNDARY
- SUBSURFACE INFILTRATION SYSTEM

SOIL KEY

SOIL CLASSIFICATION	DESCRIPTION	HYDROLOGIC SOIL GROUP
254A	MERRIMAC FINE SANDY LOAM, 0-3 PERCENT SLOPES	A
254B	MERRIMAC FINE SANDY LOAM, 3-8 PERCENT SLOPES	A
630C	CHARLTON-HOLLIS-URBAN LAND COMPLEX, 3-15 PERCENT SLOPES	A

ABBREVIATIONS	FIRST FLOOR ELEVATION
BT CONC.	BITUMINOUS CONCRETE PAVEMENT
CCB	CAPE COD BERM
EP	EDGE OF PAVEMENT
BC	BITUMINOUS CONCRETE CURB
(AM)	AS MEASURED
RET WALL	RETAINING WALL
CONC.	CONCRETE
RCP	REINFORCED CONCRETE PIPE
VCC	VERTICAL GRANITE CURB
ETW	EDGE OF TRAVEL WAY
MTL	METAL BERM
VCC	VERTICAL CONCRETE CURB
CMP	CORRUGATED METAL PIPE
TOW	TOP OF WALL
SGC	SLOPED GRANITE CURB

LEGEND

- SURVEY SYMBOLS
- REBAR
  - ANGLE IRON
  - CONCRETE BOUND WITH DRILL HOLE
  - STONE BOUND
  - STONE BOUND
- UTILITY SYMBOLS
- CHIMNEY
  - ELECTRIC HAND HOLE
  - GUY POLE
  - GUY WIRE
  - HVAC UNIT
  - BUILDING LIGHT W/MAST
  - BUILDING LIGHT
  - TRANSFORMER
  - WATER GATE
  - EXHAUST VENT
  - AIR VENT
  - DRAINAGE SUMP
  - ELECTRIC MANHOLE
  - SEWER MANHOLE
  - DRAIN MANHOLE
  - TELEPHONE MANHOLE
  - DRAINAGE CATCH BASIN
  - DOOR WAY THRESHOLD
  - HYDRANT
  - POST INDICATOR VALVE
  - UTILITY POLE
  - YARD LIGHT
  - RIP RAP
  - BOLLARD
  - SIGN
  - FIRE ALARM
  - DECIDUOUS TREE
  - CONIFEROUS TREE
- LINE DESIGNATORS
- WATER MAIN
  - HANDRAIL
  - JERSEY BARRIER
  - GUARD RAIL
  - RAILROAD TRACKS
  - OVERHEAD WIRES
  - GAS LINE
  - WATER SERVICE
  - UNDERGROUND ELECTRIC
  - STORM DRAIN LINE
  - SANITARY SEWER LINE
  - DRAINAGE SWALE
  - CHAIN LINK FENCE

BY APP	DESCRIPTION	DATE	REV

**MCKENZIE ENGINEERING GROUP**  
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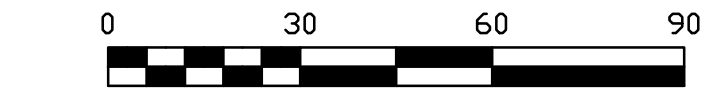
**148 WESTON ROAD**  
(PARCEL IDS 149-A, 149-1, 149-3, & 149-4)  
**140-148 WESTON ROAD**  
WELLESLEY, MASSACHUSETTS

PROFESSIONAL ENGINEER:  
  
APPLICANT:  
**WELLESLEY PARK, LLC**  
49 COOLIDGE STREET  
BROOKLINE, MASSACHUSETTS 02446

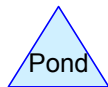
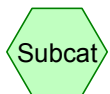
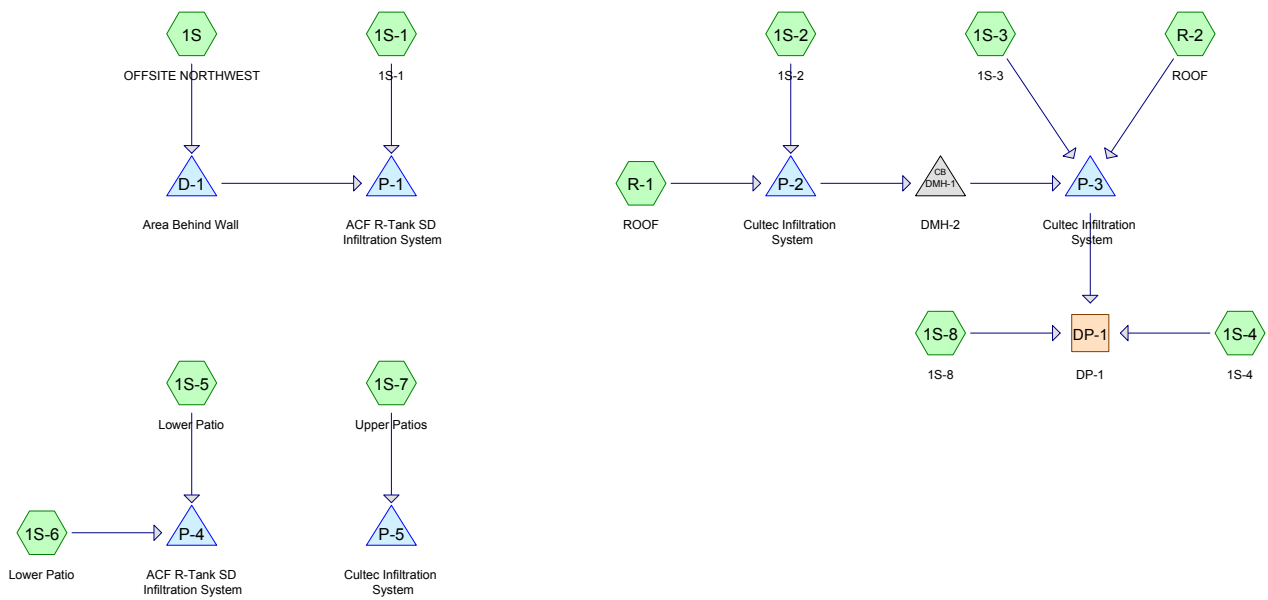
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DESIGNED BY: SBS  
CHECKED BY: BCM  
APPROVED BY: BCM  
DATE: FEBRUARY 28, 2020  
SCALE: 1"=30'  
PROJECT NO.: 217-177  
DWG. TITLE:

**POST-DEV.  
WATERSHED  
PLAN**

DWG. NO.: **WS-2**



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**Routing Diagram for 217-177 Post Development PSI**  
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## 217-177 Post Development PSI

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### Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.269	39	>75% Grass cover, Good, HSG A (1S, 1S-2, 1S-4, 1S-6, 1S-7, 1S-8)
0.203	39	>75% Grass cover, Good, HSG A (offsite) (1S)
0.057	74	>75% Grass cover, Good, HSG C (1S-3)
0.027	98	Area above garage, HSG A (1S-3)
0.038	98	Bluestone patio, HSG A (1S-2, 1S-5, 1S-6, 1S-7)
0.047	76	Gravel roads, HSG A (1S-3)
0.116	96	Gravel surface, HSG A (offsite) (1S)
0.039	98	Patio above, HSG A (1S-1, 1S-3, 1S-6, 1S-7)
0.282	98	Paved parking, HSG A (1S-1, 1S-2)
0.024	64	Permeable patio, HSG A (1S-3)
0.029	64	Permeable pavers fire lane, HSG A (1S-3)
0.026	64	Permeable pavers, HSG A (1S-1)
0.017	98	Roofs, HSG A (1S-4)
0.045	98	Roofs, HSG A (offsite) (1S)
0.001	98	Stepping stones, HSG A (1S-6, 1S-7)
0.475	98	Unconnected roofs, HSG A (R-1, R-2)
0.018	98	Walk, HSG A (1S-1, 1S-3)
0.041	98	Wall, HSG A (1S-1, 1S-2, 1S-3, 1S-4, 1S-5, 1S-6, 1S-7)
1.404	30	Woods, Good, HSG A (offsite) (1S)
<b>3.158</b>	<b>57</b>	<b>TOTAL AREA</b>

## 217-177 Post Development PSI

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### Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
3.102	HSG A	1S, 1S-1, 1S-2, 1S-3, 1S-4, 1S-5, 1S-6, 1S-7, 1S-8, R-1, R-2
0.000	HSG B	
0.057	HSG C	1S-3
0.000	HSG D	
0.000	Other	
<b>3.158</b>		<b>TOTAL AREA</b>

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### Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.473	0.000	0.057	0.000	0.000	0.530	>75% Grass cover, Good	1S, 1S-2, 1S-3, 1S-4, 1S-6, 1S-7, 1S-8
0.027	0.000	0.000	0.000	0.000	0.027	Area above garage	1S-3
0.038	0.000	0.000	0.000	0.000	0.038	Bluestone patio	1S-2, 1S-5, 1S-6, 1S-7
0.047	0.000	0.000	0.000	0.000	0.047	Gravel roads	1S-3
0.116	0.000	0.000	0.000	0.000	0.116	Gravel surface	1S
0.039	0.000	0.000	0.000	0.000	0.039	Patio above	1S-1, 1S-3, 1S-6, 1S-7
0.282	0.000	0.000	0.000	0.000	0.282	Paved parking	1S-1, 1S-2
0.024	0.000	0.000	0.000	0.000	0.024	Permeable patio	1S-3
0.026	0.000	0.000	0.000	0.000	0.026	Permeable pavers	1S-1
0.029	0.000	0.000	0.000	0.000	0.029	Permeable pavers fire lane	1S-3
0.062	0.000	0.000	0.000	0.000	0.062	Roofs	1S, 1S-4
0.001	0.000	0.000	0.000	0.000	0.001	Stepping stones	1S-6, 1S-7
0.475	0.000	0.000	0.000	0.000	0.475	Unconnected roofs	R-1, R-2
0.018	0.000	0.000	0.000	0.000	0.018	Walk	1S-1, 1S-3
0.041	0.000	0.000	0.000	0.000	0.041	Wall	1S-1, 1S-2, 1S-3, 1S-4, 1S-5, 1S-6, 1S-7
1.404	0.000	0.000	0.000	0.000	1.404	Woods, Good	1S
<b>3.102</b>	<b>0.000</b>	<b>0.057</b>	<b>0.000</b>	<b>0.000</b>	<b>3.158</b>	<b>TOTAL AREA</b>	

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### Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	DMH-1	146.96	146.00	46.0	0.0209	0.013	12.0	0.0	0.0
2	P-2	147.13	146.96	17.0	0.0100	0.013	12.0	0.0	0.0
3	P-3	146.50	146.36	14.0	0.0100	0.013	4.0	0.0	0.0

**217-177 Post Development PSI***Type III 24-hr 2-Year Rainfall=3.20"*

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Time span=0.00-48.00 hrs, dt=0.03 hrs, 1601 points x 3  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment1S: OFFSITE NORTHWEST** Runoff Area=78,453 sf 2.48% Impervious Runoff Depth=0.00"  
 Flow Length=434' Tc=16.4 min CN=37 Runoff=0.00 cfs 0.000 af

**Subcatchment1S-1: 1S-1** Runoff Area=6,026 sf 81.48% Impervious Runoff Depth=2.35"  
 Tc=5.0 min CN=92 Runoff=0.38 cfs 0.027 af

**Subcatchment1S-2: 1S-2** Runoff Area=13,675 sf 66.63% Impervious Runoff Depth=1.27"  
 Tc=5.0 min CN=78 Runoff=0.47 cfs 0.033 af

**Subcatchment1S-3: 1S-3** Runoff Area=9,337 sf 26.97% Impervious Runoff Depth=1.27"  
 Flow Length=240' Tc=6.6 min CN=78 Runoff=0.31 cfs 0.023 af

**Subcatchment1S-4: 1S-4** Runoff Area=5,139 sf 15.78% Impervious Runoff Depth=0.09"  
 Flow Length=240' Tc=6.6 min CN=48 Runoff=0.00 cfs 0.001 af

**Subcatchment1S-5: Lower Patio** Runoff Area=791 sf 100.00% Impervious Runoff Depth=2.97"  
 Flow Length=240' Tc=6.6 min CN=98 Runoff=0.06 cfs 0.004 af

**Subcatchment1S-6: Lower Patio** Runoff Area=1,492 sf 66.49% Impervious Runoff Depth=1.27"  
 Flow Length=240' Tc=6.6 min CN=78 Runoff=0.05 cfs 0.004 af

**Subcatchment1S-7: Upper Patios** Runoff Area=1,701 sf 63.84% Impervious Runoff Depth=1.21"  
 Flow Length=240' Tc=6.6 min CN=77 Runoff=0.05 cfs 0.004 af

**Subcatchment1S-8: 1S-8** Runoff Area=287 sf 0.00% Impervious Runoff Depth=0.00"  
 Flow Length=240' Tc=6.6 min CN=39 Runoff=0.00 cfs 0.000 af

**SubcatchmentR-1: ROOF** Runoff Area=7,191 sf 100.00% Impervious Runoff Depth=2.97"  
 Tc=5.0 min CN=98 Runoff=0.53 cfs 0.041 af

**SubcatchmentR-2: ROOF** Runoff Area=13,482 sf 100.00% Impervious Runoff Depth=2.97"  
 Tc=5.0 min CN=98 Runoff=0.99 cfs 0.077 af

**Reach DP-1: DP-1** Inflow=0.00 cfs 0.001 af  
 Outflow=0.00 cfs 0.001 af

**Pond D-1: Area Behind Wall** Peak Elev=148.00' Storage=0 cf Inflow=0.00 cfs 0.000 af  
 Outflow=0.00 cfs 0.000 af

**Pond DMH-1: DMH-2** Peak Elev=146.96' Inflow=0.00 cfs 0.000 af  
 12.0" Round Culvert n=0.013 L=46.0' S=0.0209 ' /' Outflow=0.00 cfs 0.000 af

**Pond P-1: ACF R-Tank SD Infiltration System** Peak Elev=138.38' Storage=77 cf Inflow=0.38 cfs 0.027 af  
 Outflow=0.21 cfs 0.027 af

**Pond P-2: Cultec Infiltration System** Peak Elev=147.54' Storage=616 cf Inflow=1.00 cfs 0.074 af  
 Discarded=0.27 cfs 0.074 af Primary=0.00 cfs 0.000 af Outflow=0.27 cfs 0.074 af

## 217-177 Post Development PSI

Type III 24-hr 2-Year Rainfall=3.20"

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**Pond P-3: Cultec Infiltration System**      Peak Elev=144.93'   Storage=1,404 cf   Inflow=1.27 cfs   0.099 af  
Discarded=0.14 cfs   0.099 af   Primary=0.00 cfs   0.000 af   Outflow=0.14 cfs   0.099 af

**Pond P-4: ACF R-Tank SD Infiltration System**      Peak Elev=138.45'   Storage=87 cf   Inflow=0.10 cfs   0.008 af  
Outflow=0.02 cfs   0.008 af

**Pond P-5: Cultec Infiltration System**      Peak Elev=147.84'   Storage=50 cf   Inflow=0.05 cfs   0.004 af  
Outflow=0.01 cfs   0.004 af

**Total Runoff Area = 3.158 ac   Runoff Volume = 0.213 af   Average Runoff Depth = 0.81"**  
**68.86% Pervious = 2.175 ac   31.14% Impervious = 0.983 ac**

**217-177 Post Development PSI**

Type III 24-hr 2-Year Rainfall=3.20"

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**Summary for Subcatchment 1S: OFFSITE NORTHWEST**

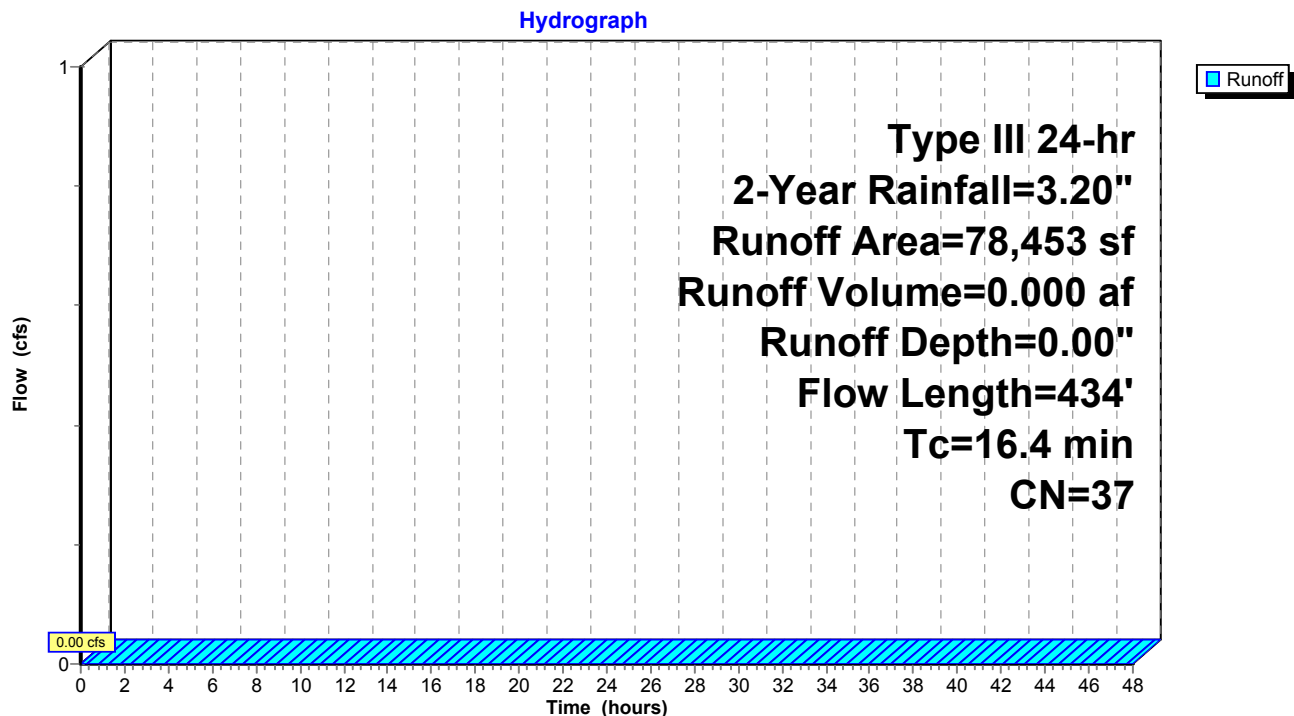
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
* 61,141	30	Woods, Good, HSG A (offsite)
* 5,064	96	Gravel surface, HSG A (offsite)
* 8,863	39	>75% Grass cover, Good, HSG A (offsite)
* 1,942	98	Roofs, HSG A (offsite)
1,443	39	>75% Grass cover, Good, HSG A
78,453	37	Weighted Average
76,511		97.52% Pervious Area
1,942		2.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	50	0.0150	0.06		<b>Sheet Flow, SHEET FLOW</b>
					Woods: Light underbrush n= 0.400 P2= 3.20"
2.6	384	0.0236	2.47		<b>Shallow Concentrated Flow, SHALLOW CONC. FLOW</b>
					Unpaved Kv= 16.1 fps
16.4	434	Total			

**Subcatchment 1S: OFFSITE NORTHWEST**

**217-177 Post Development PSI**

Type III 24-hr 2-Year Rainfall=3.20"

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**Summary for Subcatchment 1S-1: 1S-1**

Runoff = 0.38 cfs @ 12.07 hrs, Volume= 0.027 af, Depth= 2.35"

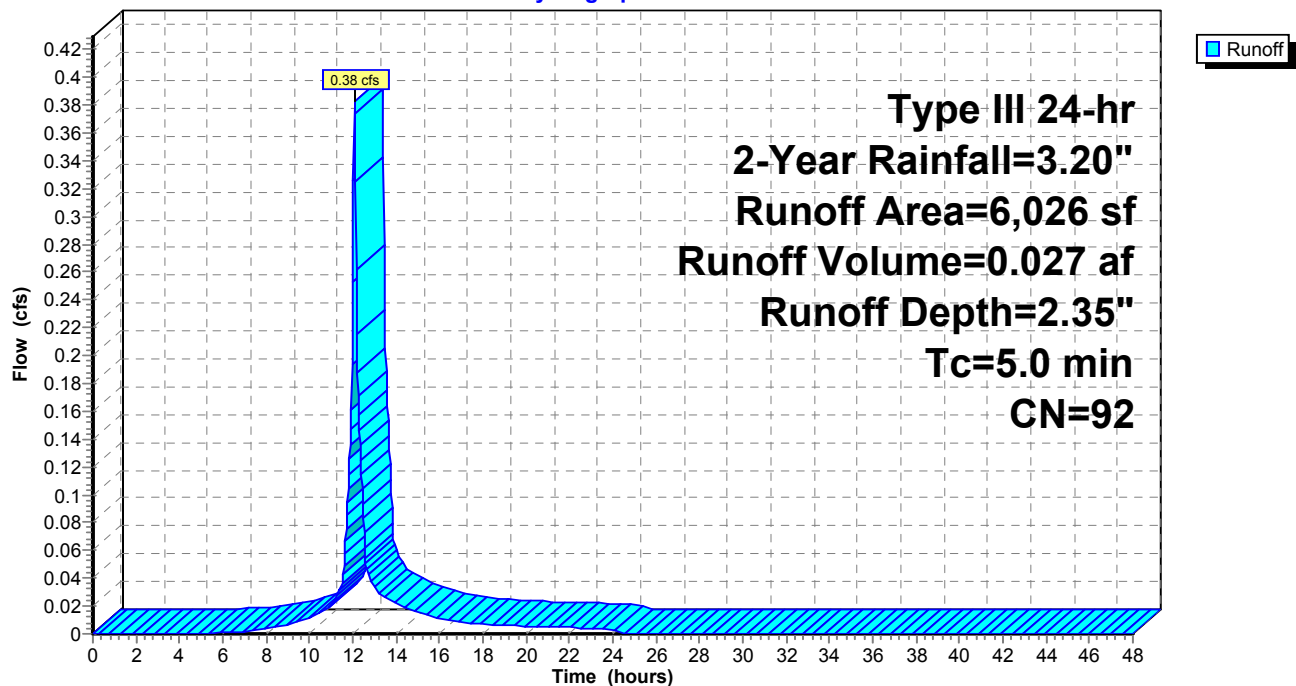
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 2-Year Rainfall=3.20"

	Area (sf)	CN	Description
*	1,116	64	Permeable pavers, HSG A
	3,665	98	Paved parking, HSG A
*	401	98	Patio above, HSG A
*	552	98	Wall, HSG A
*	292	98	Walk, HSG A
	6,026	92	Weighted Average
	1,116		18.52% Pervious Area
	4,910		81.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry, direct

**Subcatchment 1S-1: 1S-1**

Hydrograph



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Type III 24-hr 2-Year Rainfall=3.20"

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**Summary for Subcatchment 1S-2: 1S-2**

Runoff = 0.47 cfs @ 12.08 hrs, Volume= 0.033 af, Depth= 1.27"

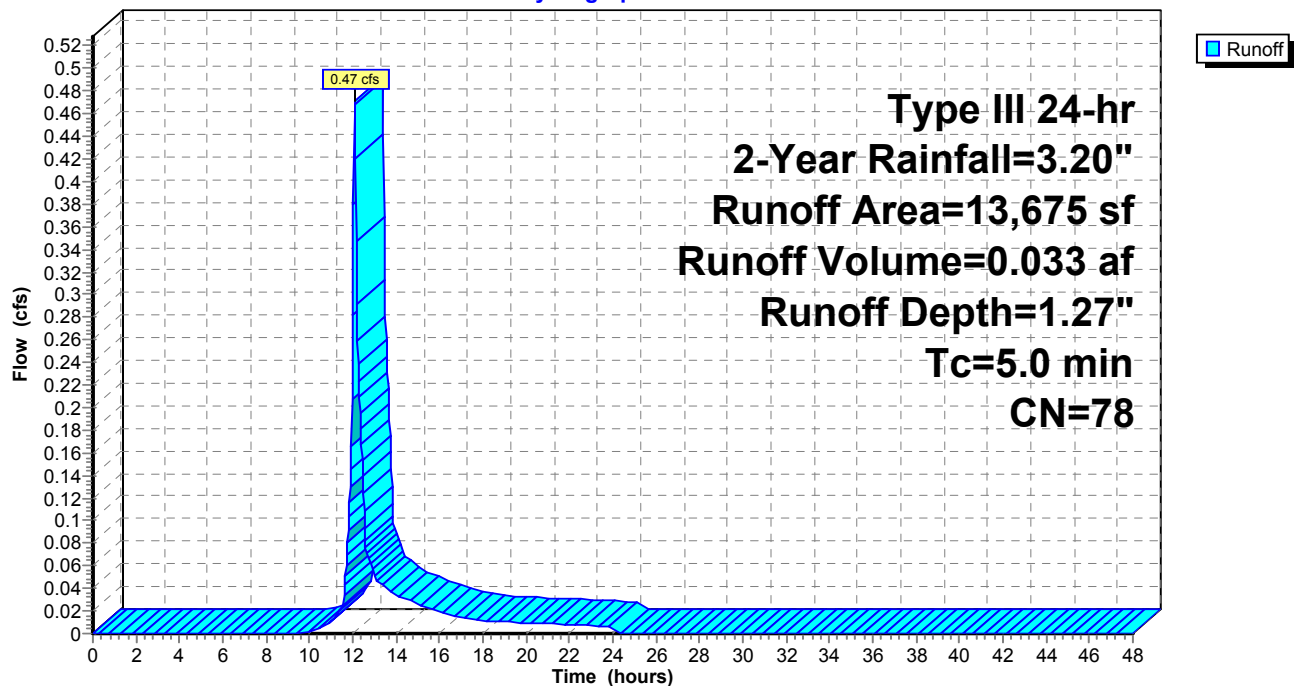
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
4,564	39	>75% Grass cover, Good, HSG A
8,635	98	Paved parking, HSG A
* 226	98	Wall, HSG A
* 250	98	Bluestone patio, HSG A
13,675	78	Weighted Average
4,564		33.37% Pervious Area
9,111		66.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry, direct

**Subcatchment 1S-2: 1S-2**

Hydrograph



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Type III 24-hr 2-Year Rainfall=3.20"

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**Summary for Subcatchment 1S-3: 1S-3**

Runoff = 0.31 cfs @ 12.10 hrs, Volume= 0.023 af, Depth= 1.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 2-Year Rainfall=3.20"

	Area (sf)	CN	Description
*	1,256	64	Permeable pavers fire lane, HSG A
*	592	98	Wall, HSG A
*	243	98	Patio above, HSG A
*	1,053	64	Permeable patio, HSG A
*	509	98	Walk, HSG A
*	1,174	98	Area above garage, HSG A
	2,468	74	>75% Grass cover, Good, HSG C
	2,042	76	Gravel roads, HSG A
	9,337	78	Weighted Average
	6,819		73.03% Pervious Area
	2,518		26.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		<b>Sheet Flow, sheet</b>
					Grass: Short n= 0.150 P2= 3.20"
1.0	190	0.0370	3.10		<b>Shallow Concentrated Flow, conc.</b>
					Unpaved Kv= 16.1 fps
6.6	240	Total			

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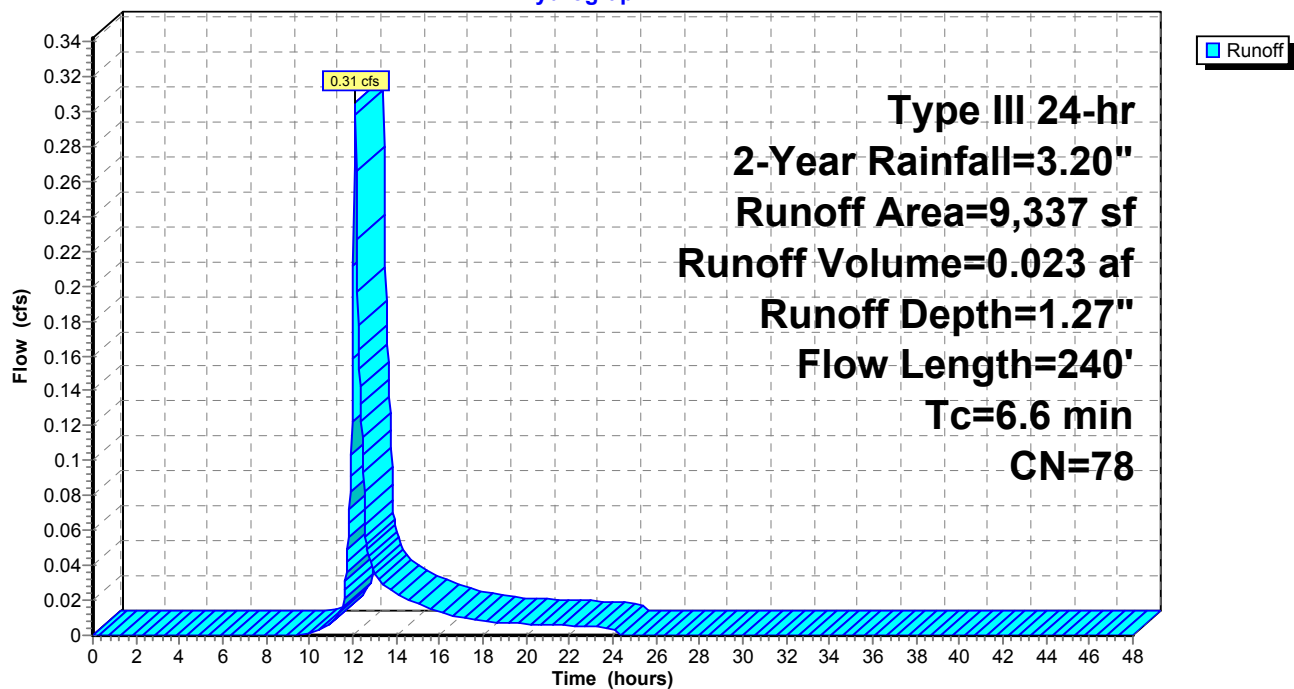
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Type III 24-hr 2-Year Rainfall=3.20"

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### Subcatchment 1S-3: 1S-3

Hydrograph



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Type III 24-hr 2-Year Rainfall=3.20"

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**Summary for Subcatchment 1S-4: 1S-4**

Runoff = 0.00 cfs @ 14.56 hrs, Volume= 0.001 af, Depth= 0.09"

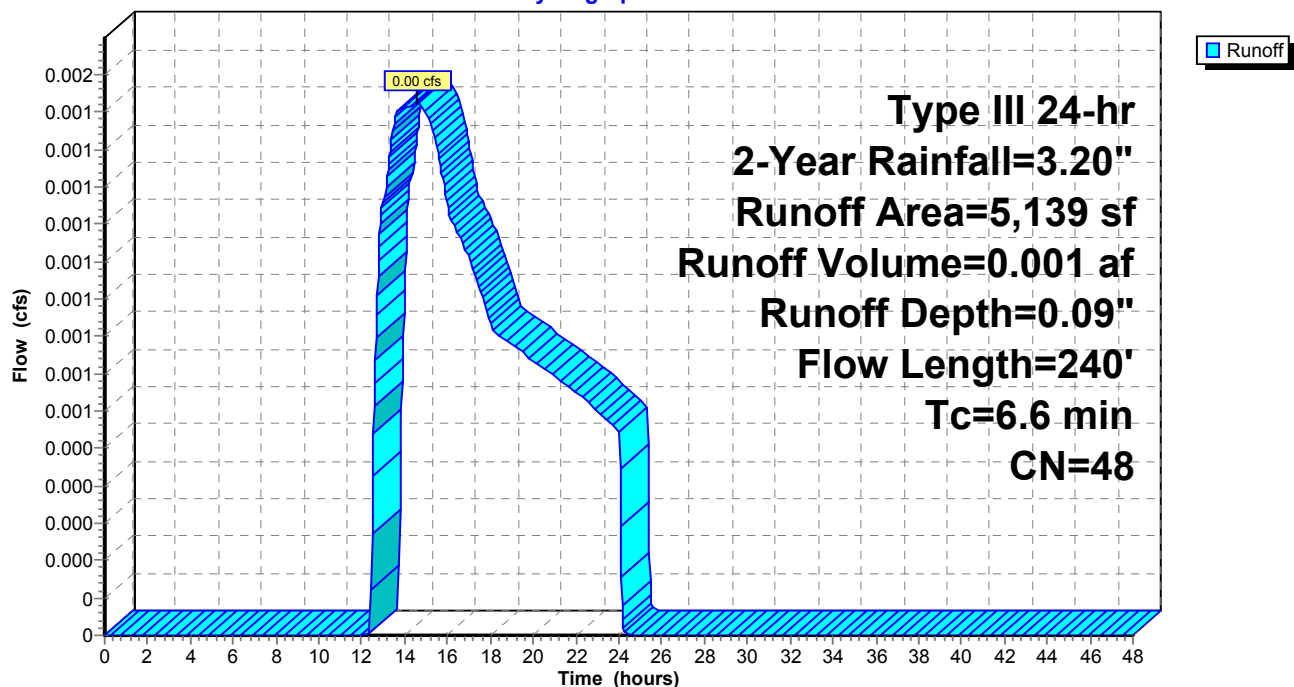
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
4,328	39	>75% Grass cover, Good, HSG A
* 72	98	Wall, HSG A
739	98	Roofs, HSG A
5,139	48	Weighted Average
4,328		84.22% Pervious Area
811		15.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		<b>Sheet Flow, sheet</b>
					Grass: Short n= 0.150 P2= 3.20"
1.0	190	0.0370	3.10		<b>Shallow Concentrated Flow, conc.</b>
					Unpaved Kv= 16.1 fps
6.6	240	Total			

**Subcatchment 1S-4: 1S-4**

Hydrograph



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Type III 24-hr 2-Year Rainfall=3.20"

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**Summary for Subcatchment 1S-5: Lower Patio**

Runoff = 0.06 cfs @ 12.09 hrs, Volume= 0.004 af, Depth= 2.97"

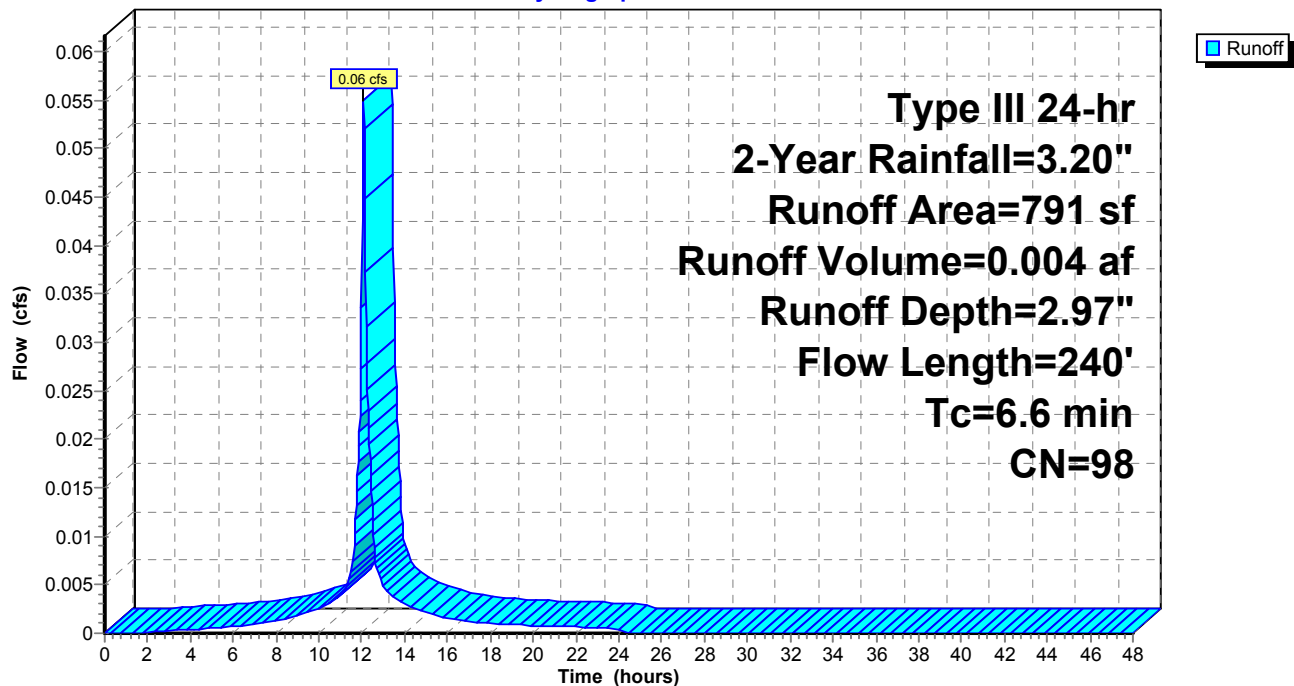
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 2-Year Rainfall=3.20"

	Area (sf)	CN	Description
*	625	98	Bluestone patio, HSG A
*	166	98	Wall, HSG A
	791	98	Weighted Average
	791		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		<b>Sheet Flow, sheet</b>
					Grass: Short n= 0.150 P2= 3.20"
1.0	190	0.0370	3.10		<b>Shallow Concentrated Flow, conc.</b>
					Unpaved Kv= 16.1 fps
6.6	240	Total			

**Subcatchment 1S-5: Lower Patio**

Hydrograph



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Type III 24-hr 2-Year Rainfall=3.20"

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**Summary for Subcatchment 1S-6: Lower Patio**

Runoff = 0.05 cfs @ 12.10 hrs, Volume= 0.004 af, Depth= 1.27"

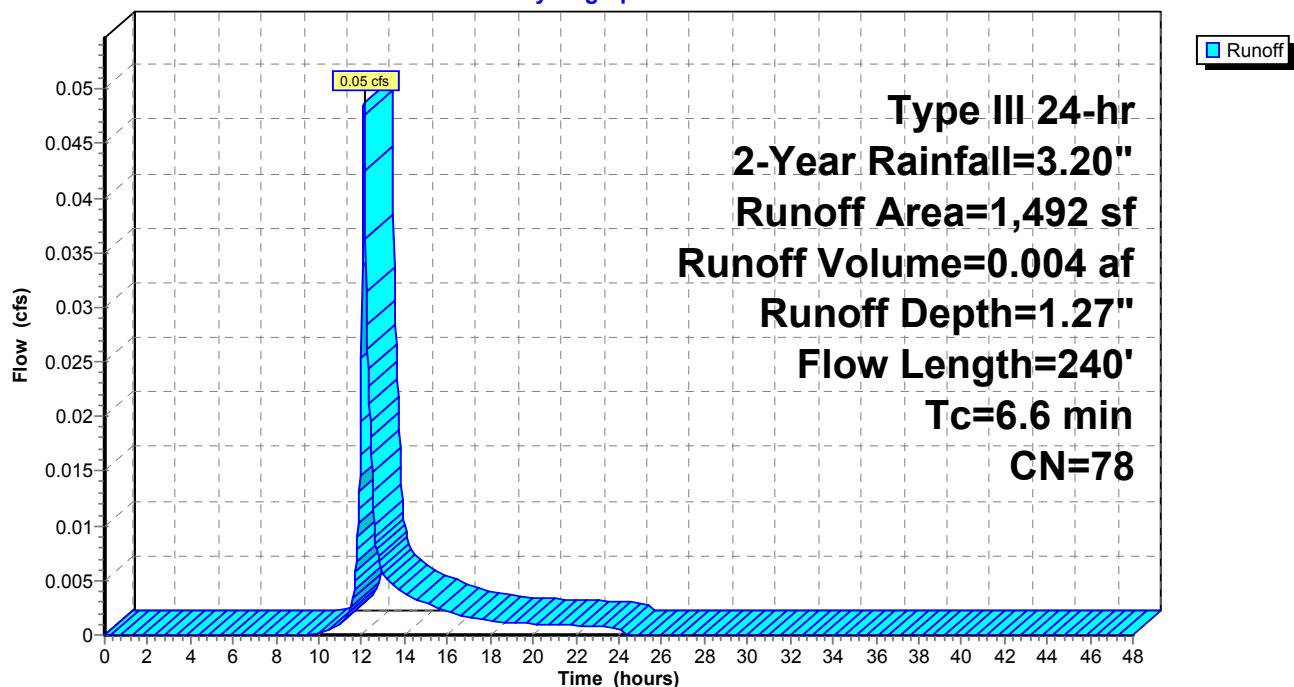
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
500	39	>75% Grass cover, Good, HSG A
* 765	98	Bluestone patio, HSG A
* 120	98	Wall, HSG A
* 9	98	Stepping stones, HSG A
* 98	98	Patio above, HSG A
1,492	78	Weighted Average
500		33.51% Pervious Area
992		66.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		<b>Sheet Flow, sheet</b>
					Grass: Short n= 0.150 P2= 3.20"
1.0	190	0.0370	3.10		<b>Shallow Concentrated Flow, conc.</b>
					Unpaved Kv= 16.1 fps
6.6	240	Total			

**Subcatchment 1S-6: Lower Patio**

Hydrograph



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Type III 24-hr 2-Year Rainfall=3.20"

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**Summary for Subcatchment 1S-7: Upper Patios**

Runoff = 0.05 cfs @ 12.10 hrs, Volume= 0.004 af, Depth= 1.21"

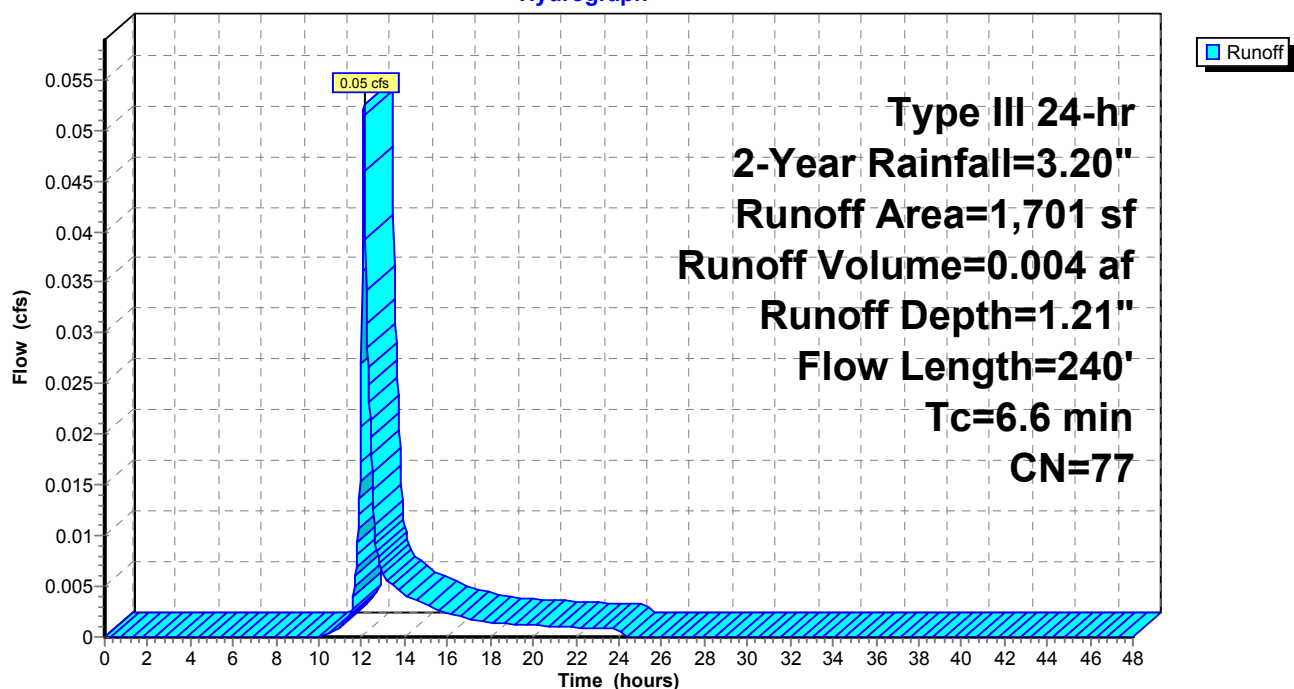
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
615	39	>75% Grass cover, Good, HSG A
* 73	98	Wall, HSG A
* 30	98	Bluestone patio, HSG A
* 970	98	Patio above, HSG A
* 13	98	Stepping stones, HSG A
1,701	77	Weighted Average
615		36.16% Pervious Area
1,086		63.84% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		<b>Sheet Flow, sheet</b>
					Grass: Short n= 0.150 P2= 3.20"
1.0	190	0.0370	3.10		<b>Shallow Concentrated Flow, conc.</b>
					Unpaved Kv= 16.1 fps
6.6	240	Total			

**Subcatchment 1S-7: Upper Patios**

Hydrograph



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Type III 24-hr 2-Year Rainfall=3.20"

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**Summary for Subcatchment 1S-8: 1S-8**

Runoff = 0.00 cfs @ 23.99 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 2-Year Rainfall=3.20"

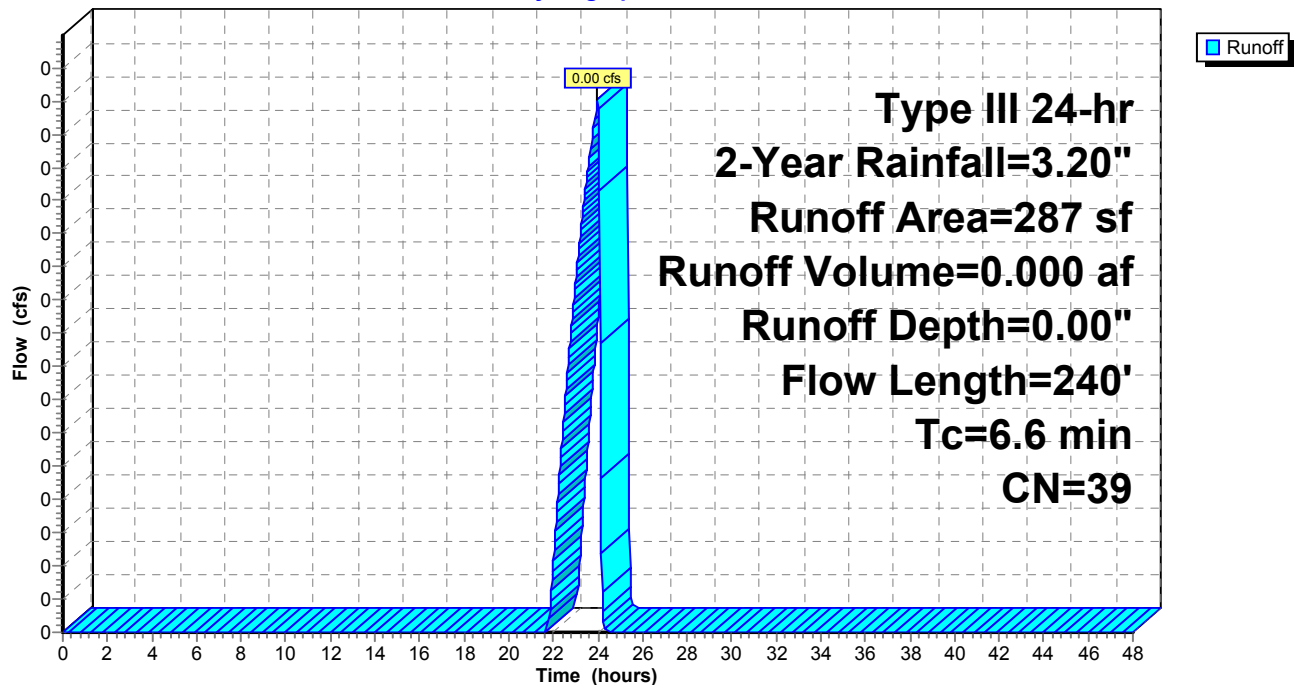
Area (sf)	CN	Description
287	39	>75% Grass cover, Good, HSG A
287		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		<b>Sheet Flow, sheet</b>
					Grass: Short n= 0.150 P2= 3.20"
1.0	190	0.0370	3.10		<b>Shallow Concentrated Flow, conc.</b>
					Unpaved Kv= 16.1 fps
6.6	240	Total			

**Subcatchment 1S-8: 1S-8**

Hydrograph



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Type III 24-hr 2-Year Rainfall=3.20"

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### Summary for Subcatchment R-1: ROOF

Runoff = 0.53 cfs @ 12.07 hrs, Volume= 0.041 af, Depth= 2.97"

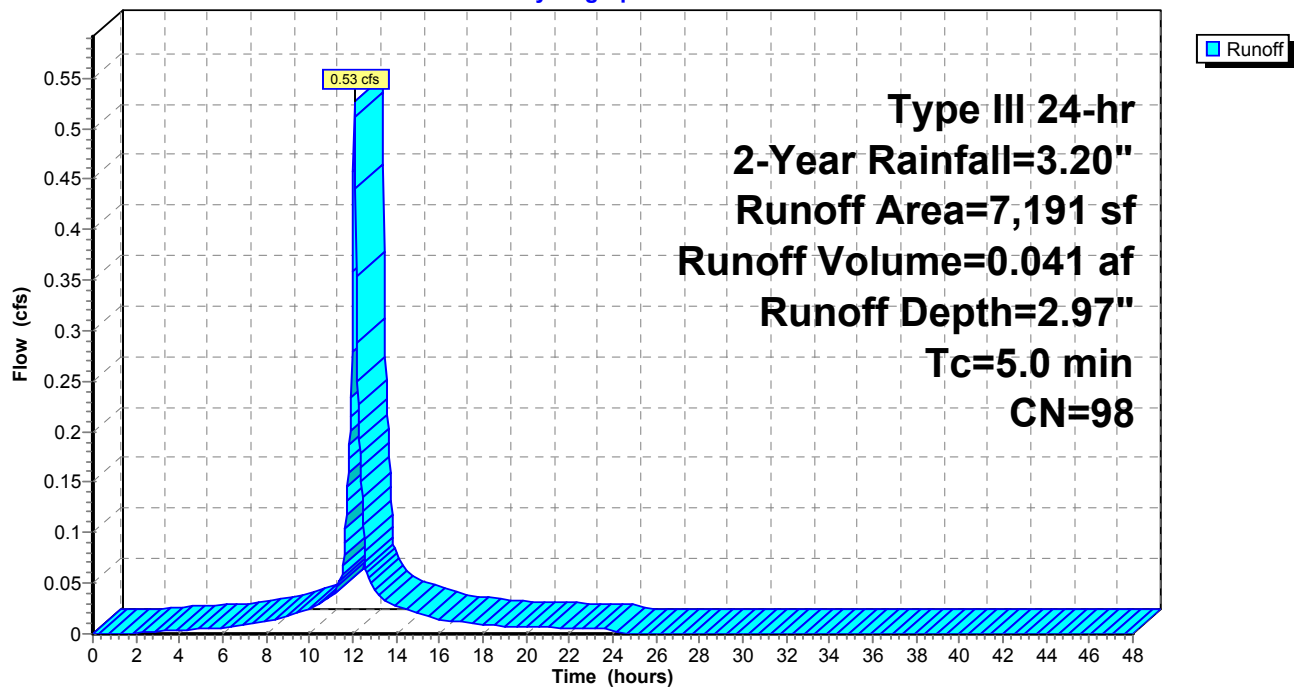
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
7,191	98	Unconnected roofs, HSG A
7,191		100.00% Impervious Area
7,191		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry, direct

### Subcatchment R-1: ROOF

Hydrograph



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Type III 24-hr 2-Year Rainfall=3.20"

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### Summary for Subcatchment R-2: ROOF

Runoff = 0.99 cfs @ 12.07 hrs, Volume= 0.077 af, Depth= 2.97"

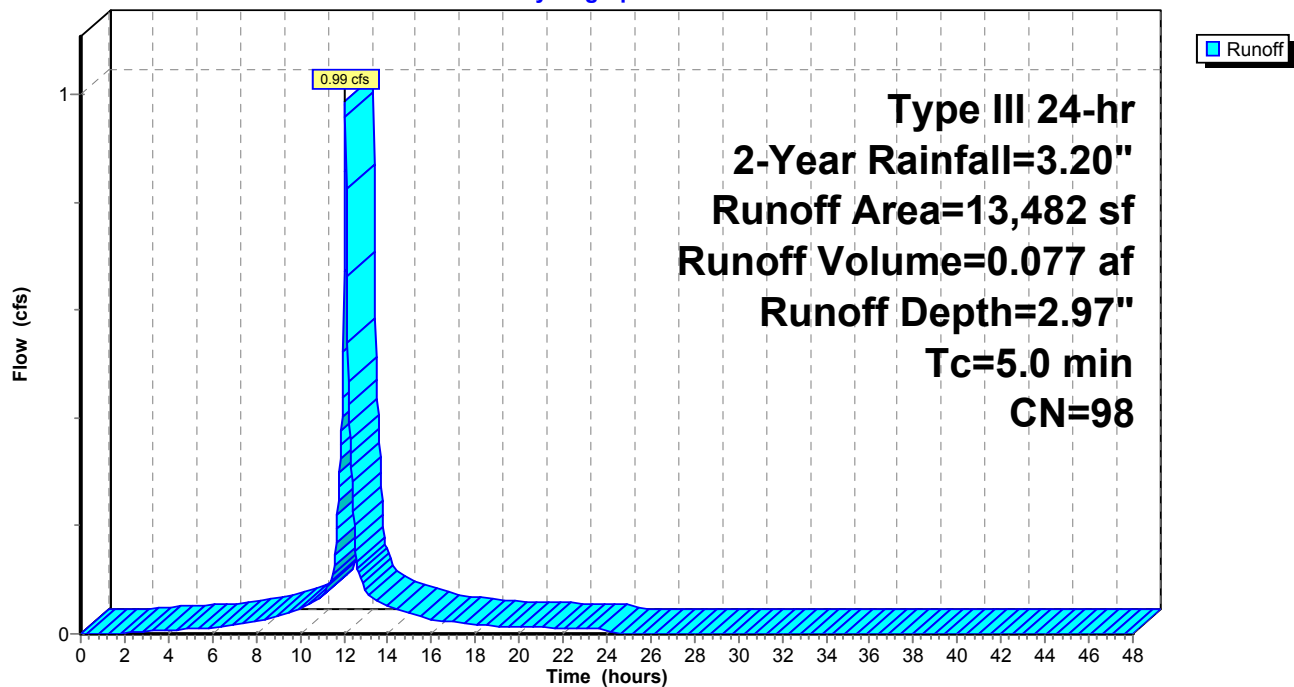
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 2-Year Rainfall=3.20"

Area (sf)	CN	Description
13,482	98	Unconnected roofs, HSG A
13,482		100.00% Impervious Area
13,482		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry, direct

### Subcatchment R-2: ROOF

Hydrograph



## 217-177 Post Development PSI

Type III 24-hr 2-Year Rainfall=3.20"

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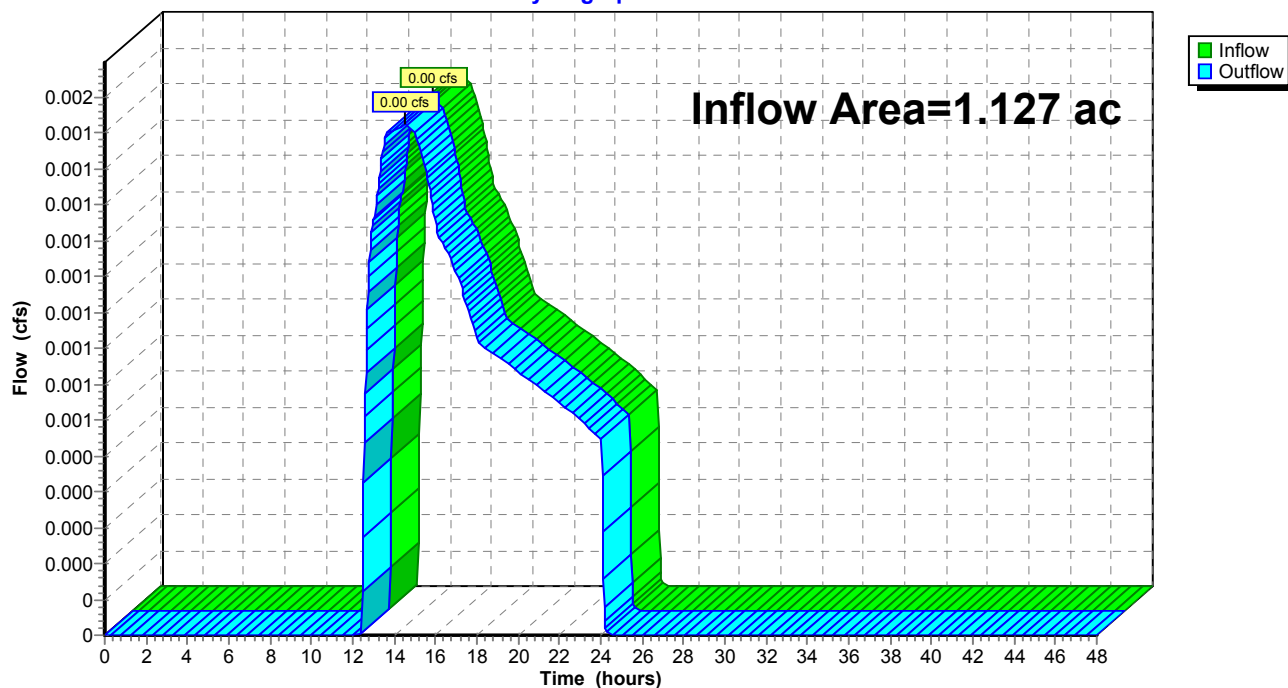
### Summary for Reach DP-1: DP-1

Inflow Area = 1.127 ac, 67.42% Impervious, Inflow Depth = 0.01" for 2-Year event  
Inflow = 0.00 cfs @ 14.56 hrs, Volume= 0.001 af  
Outflow = 0.00 cfs @ 14.56 hrs, Volume= 0.001 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs / 3

### Reach DP-1: DP-1

#### Hydrograph



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**Summary for Pond D-1: Area Behind Wall**

Inflow Area = 1.801 ac, 2.48% Impervious, Inflow Depth = 0.00" for 2-Year event  
 Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs / 3  
 Peak Elev= 148.00' @ 0.00 hrs Surf.Area= 173 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)  
 Center-of-Mass det. time= (not calculated: no inflow)

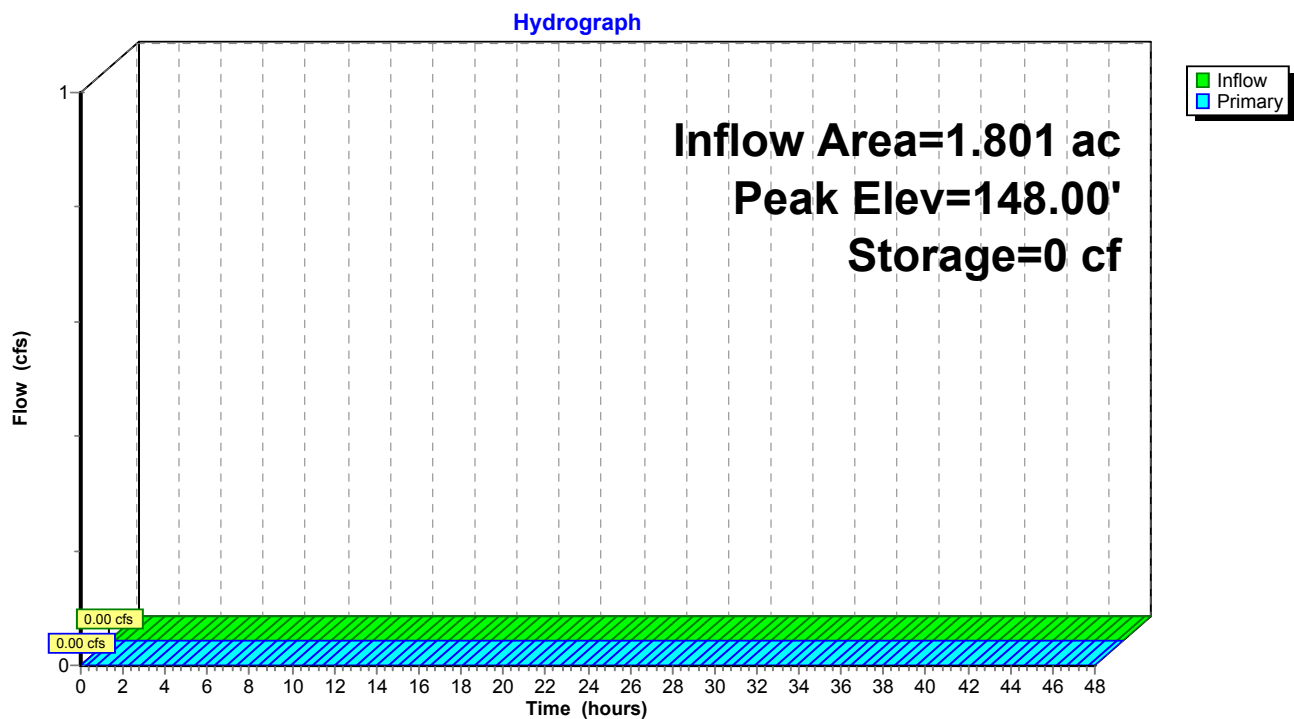
Volume	Invert	Avail.Storage	Storage Description
#1	148.00'	1,496 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
148.00	173	0	0
149.00	637	405	405
150.00	1,545	1,091	1,496

Device	Routing	Invert	Outlet Devices
#1	Primary	148.00'	<b>2.0" Horiz. Orifice/Grate X 3.00</b> C= 0.600 Limited to weir flow at low heads

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=148.00' TW=138.20' (Dynamic Tailwater)  
 ↑ **1=Orifice/Grate** ( Controls 0.00 cfs)

Pond D-1: Area Behind Wall



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### Summary for Pond DMH-1: DMH-2

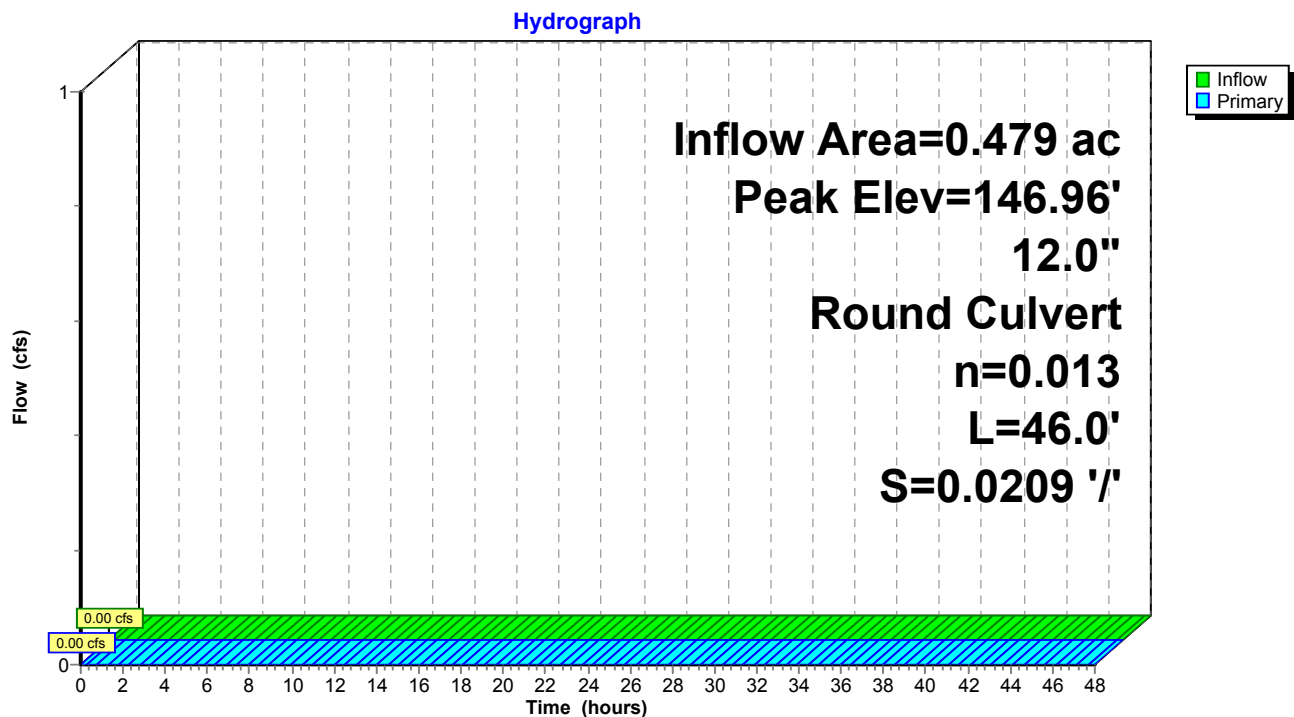
Inflow Area = 0.479 ac, 78.13% Impervious, Inflow Depth = 0.00" for 2-Year event  
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min  
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs / 3  
Peak Elev= 146.96' @ 0.00 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	146.96'	<b>12.0" Round Culvert</b> L= 46.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 146.96' / 146.00' S= 0.0209 '/ Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=146.96' TW=144.00' (Dynamic Tailwater)  
↑1=Culvert ( Controls 0.00 cfs)

### Pond DMH-1: DMH-2



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**Summary for Pond P-1: ACF R-Tank SD Infiltration System**

Inflow Area = 1.939 ac, 8.11% Impervious, Inflow Depth = 0.17" for 2-Year event  
 Inflow = 0.38 cfs @ 12.07 hrs, Volume= 0.027 af  
 Outflow = 0.21 cfs @ 12.03 hrs, Volume= 0.027 af, Atten= 46%, Lag= 0.0 min  
 Discarded = 0.21 cfs @ 12.03 hrs, Volume= 0.027 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs / 3  
 Peak Elev= 138.38' @ 12.19 hrs Surf.Area= 1,087 sf Storage= 77 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 1.4 min ( 798.3 - 796.8 )

Volume	Invert	Avail.Storage	Storage Description
#1A	138.20'	664 cf	<b>22.37'W x 48.57'L x 2.12'H Field A</b> 2,304 cf Overall - 645 cf Embedded = 1,660 cf x 40.0% Voids
#2A	138.53'	613 cf	<b>ACF R-Tank SD 1 x 266 Inside #1</b> Inside= 15.7"W x 9.4"H => 0.98 sf x 2.35'L = 2.3 cf Outside= 15.7"W x 9.4"H => 1.03 sf x 2.35'L = 2.4 cf 14 Rows of 19 Chambers
		1,276 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	138.20'	<b>8.270 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'

**Discarded OutFlow** Max=0.21 cfs @ 12.03 hrs HW=138.24' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.21 cfs)

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Type III 24-hr 2-Year Rainfall=3.20"

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### Pond P-1: ACF R-Tank SD Infiltration System - Chamber Wizard Field A

#### Chamber Model = ACF R-Tank SD 1 (ACF Environmental R-Tank SD)

Inside= 15.7"W x 9.4"H => 0.98 sf x 2.35'L = 2.3 cf

Outside= 15.7"W x 9.4"H => 1.03 sf x 2.35'L = 2.4 cf

19 Chambers/Row x 2.35' Long = 44.57' Row Length +24.0" End Stone x 2 = 48.57' Base Length

14 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 22.37' Base Width

4.0" Base + 9.4" Chamber Height + 12.0" Cover = 2.12' Field Height

266 Chambers x 2.3 cf = 612.5 cf Chamber Storage

266 Chambers x 2.4 cf = 644.8 cf Displacement

2,304.5 cf Field - 644.8 cf Chambers = 1,659.7 cf Stone x 40.0% Voids = 663.9 cf Stone Storage

Chamber Storage + Stone Storage = 1,276.4 cf = 0.029 af

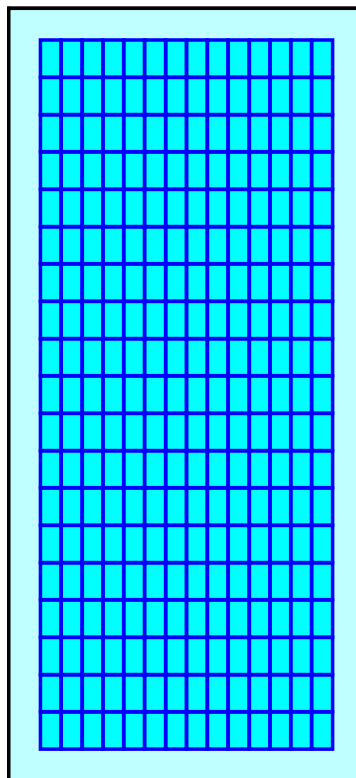
Overall Storage Efficiency = 55.4%

Overall System Size = 48.57' x 22.37' x 2.12'

266 Chambers

85.4 cy Field

61.5 cy Stone



## 217-177 Post Development PSI

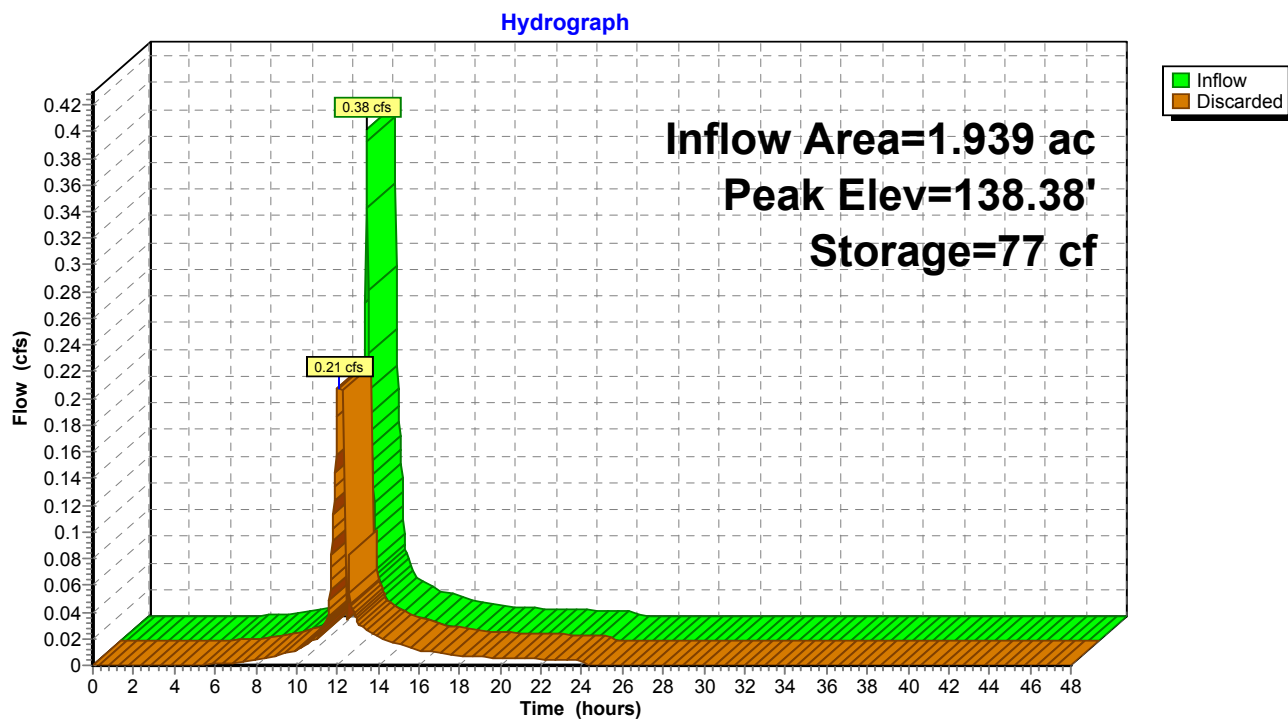
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### Pond P-1: ACF R-Tank SD Infiltration System



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**Summary for Pond P-2: Cultec Infiltration System**

Inflow Area = 0.479 ac, 78.13% Impervious, Inflow Depth = 1.86" for 2-Year event  
 Inflow = 1.00 cfs @ 12.07 hrs, Volume= 0.074 af  
 Outflow = 0.27 cfs @ 11.91 hrs, Volume= 0.074 af, Atten= 73%, Lag= 0.0 min  
 Discarded = 0.27 cfs @ 11.91 hrs, Volume= 0.074 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs / 3

Peak Elev= 147.54' @ 12.44 hrs Surf.Area= 1,531 sf Storage= 616 cf

Plug-Flow detention time= 13.0 min calculated for 0.074 af (100% of inflow)

Center-of-Mass det. time= 13.0 min ( 810.2 - 797.2 )

Volume	Invert	Avail.Storage	Storage Description
#1A	146.80'	1,317 cf	<b>20.83'W x 73.50'L x 3.54'H Field A</b> 5,423 cf Overall - 2,131 cf Embedded = 3,292 cf x 40.0% Voids
#2A	147.30'	2,131 cf	<b>Cultec R-330XLHD x 40 Inside #1</b> Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 4 rows
		3,448 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	147.13'	<b>12.0" Round 147.13</b> L= 17.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 147.13' / 146.96' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	149.35'	<b>4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)</b>
#3	Discarded	146.80'	<b>Special &amp; User-Defined</b> Head (feet) 0.00 0.10 0.50 1.00 1.50 1.51 1.52 2.00 3.54 Disch. (cfs) 0.000 0.270 0.270 0.270 0.270 0.270 0.000 0.000 0.000

**Discarded OutFlow** Max=0.27 cfs @ 11.91 hrs HW=146.92' (Free Discharge)↑**3=Special & User-Defined** (Custom Controls 0.27 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=146.80' TW=146.96' (Dynamic Tailwater)↑**1=147.13** ( Controls 0.00 cfs)↑**2=Sharp-Crested Rectangular Weir**( Controls 0.00 cfs)

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### Pond P-2: Cultec Infiltration System - Chamber Wizard Field A

#### Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 4 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

10 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 71.50' Row Length +12.0" End Stone x 2 = 73.50' Base Length

4 Rows x 52.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 20.83' Base Width

6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

40 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 4 Rows = 2,131.0 cf Chamber Storage

5,423.2 cf Field - 2,131.0 cf Chambers = 3,292.2 cf Stone x 40.0% Voids = 1,316.9 cf Stone Storage

Chamber Storage + Stone Storage = 3,447.9 cf = 0.079 af

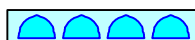
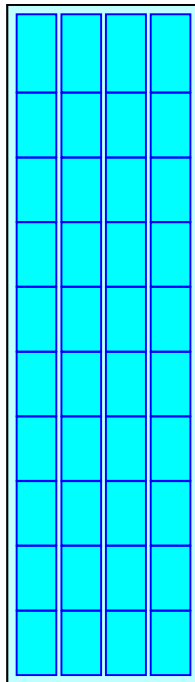
Overall Storage Efficiency = 63.6%

Overall System Size = 73.50' x 20.83' x 3.54'

40 Chambers

200.9 cy Field

121.9 cy Stone



## 217-177 Post Development PSI

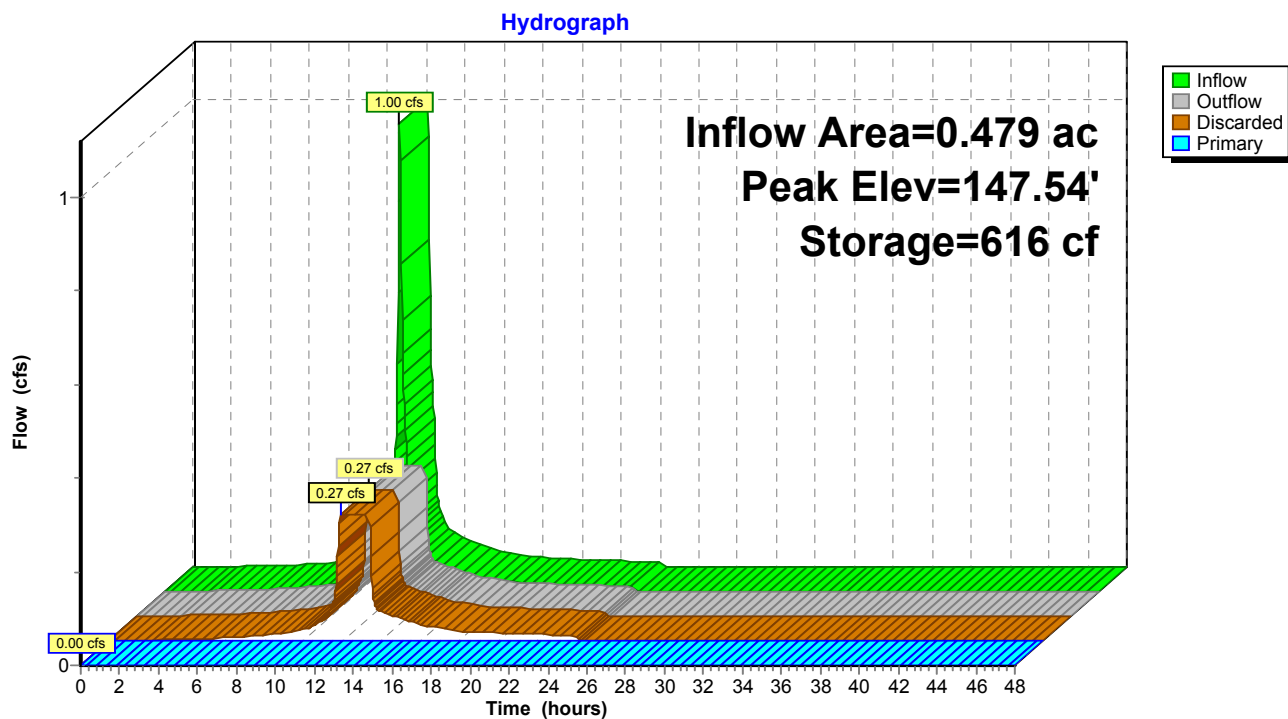
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Type III 24-hr 2-Year Rainfall=3.20"

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### Pond P-2: Cultec Infiltration System



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**Summary for Pond P-3: Cultec Infiltration System**

Inflow Area = 1.003 ac, 73.94% Impervious, Inflow Depth = 1.19" for 2-Year event  
 Inflow = 1.27 cfs @ 12.08 hrs, Volume= 0.099 af  
 Outflow = 0.14 cfs @ 11.70 hrs, Volume= 0.099 af, Atten= 89%, Lag= 0.0 min  
 Discarded = 0.14 cfs @ 11.70 hrs, Volume= 0.099 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs / 3

Peak Elev= 144.93' @ 12.82 hrs Surf.Area= 2,477 sf Storage= 1,404 cf

Plug-Flow detention time= 70.2 min calculated for 0.099 af (100% of inflow)

Center-of-Mass det. time= 70.1 min ( 847.2 - 777.1 )

Volume	Invert	Avail.Storage	Storage Description
#1A	144.00'	2,095 cf	<b>64.33'W x 38.50'L x 3.54'H Field A</b> 8,772 cf Overall - 3,535 cf Embedded = 5,237 cf x 40.0% Voids
#2A	144.50'	3,535 cf	<b>Cultec R-330XLHD x 65 Inside #1</b> Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 13 rows
		5,630 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	146.50'	<b>4.0" Round Culvert</b> L= 14.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 146.50' / 146.36' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.09 sf
#2	Discarded	144.00'	<b>2.410 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'

**Discarded OutFlow** Max=0.14 cfs @ 11.70 hrs HW=144.04' (Free Discharge)↑**2=Exfiltration** (Exfiltration Controls 0.14 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=144.00' TW=0.00' (Dynamic Tailwater)↑**1=Culvert** ( Controls 0.00 cfs)

## 217-177 Post Development PSI

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### Pond P-3: Cultec Infiltration System - Chamber Wizard Field A

#### Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 13 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

5 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 36.50' Row Length +12.0" End Stone x 2 = 38.50' Base Length

13 Rows x 52.0" Wide + 6.0" Spacing x 12 + 12.0" Side Stone x 2 = 64.33' Base Width

6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

65 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 13 Rows = 3,535.5 cf Chamber Storage

8,772.1 cf Field - 3,535.5 cf Chambers = 5,236.6 cf Stone x 40.0% Voids = 2,094.6 cf Stone Storage

Chamber Storage + Stone Storage = 5,630.1 cf = 0.129 af

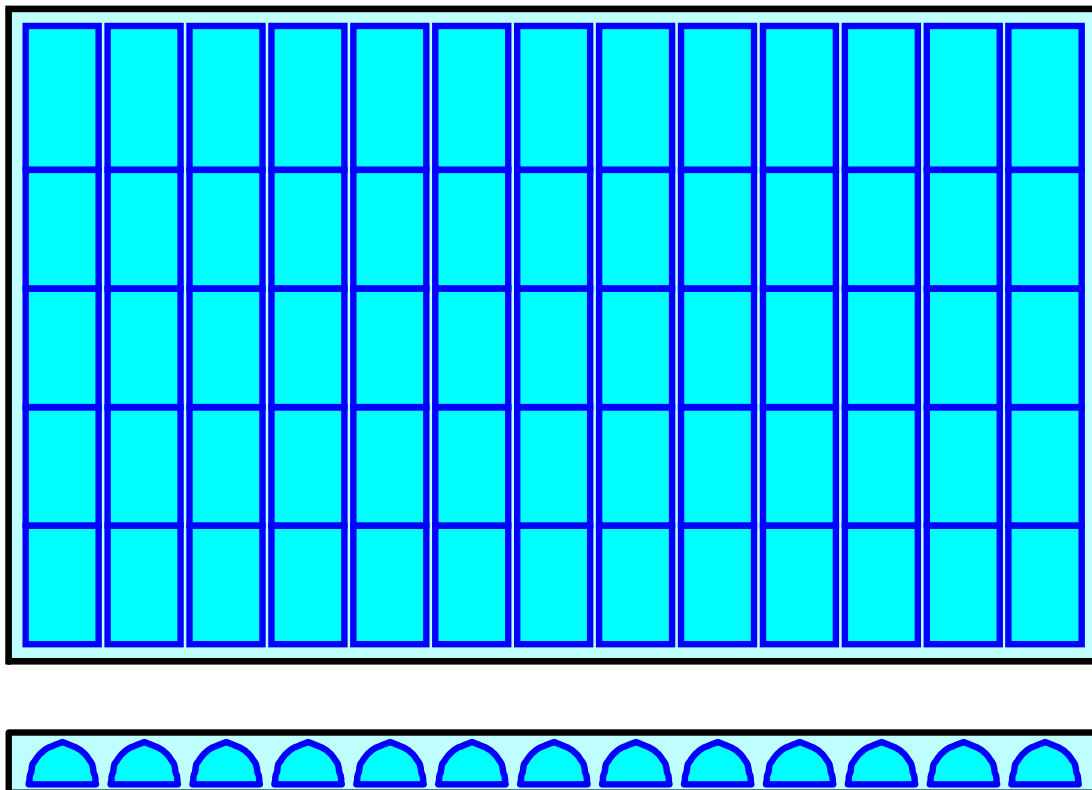
Overall Storage Efficiency = 64.2%

Overall System Size = 38.50' x 64.33' x 3.54'

65 Chambers

324.9 cy Field

193.9 cy Stone



## 217-177 Post Development PSI

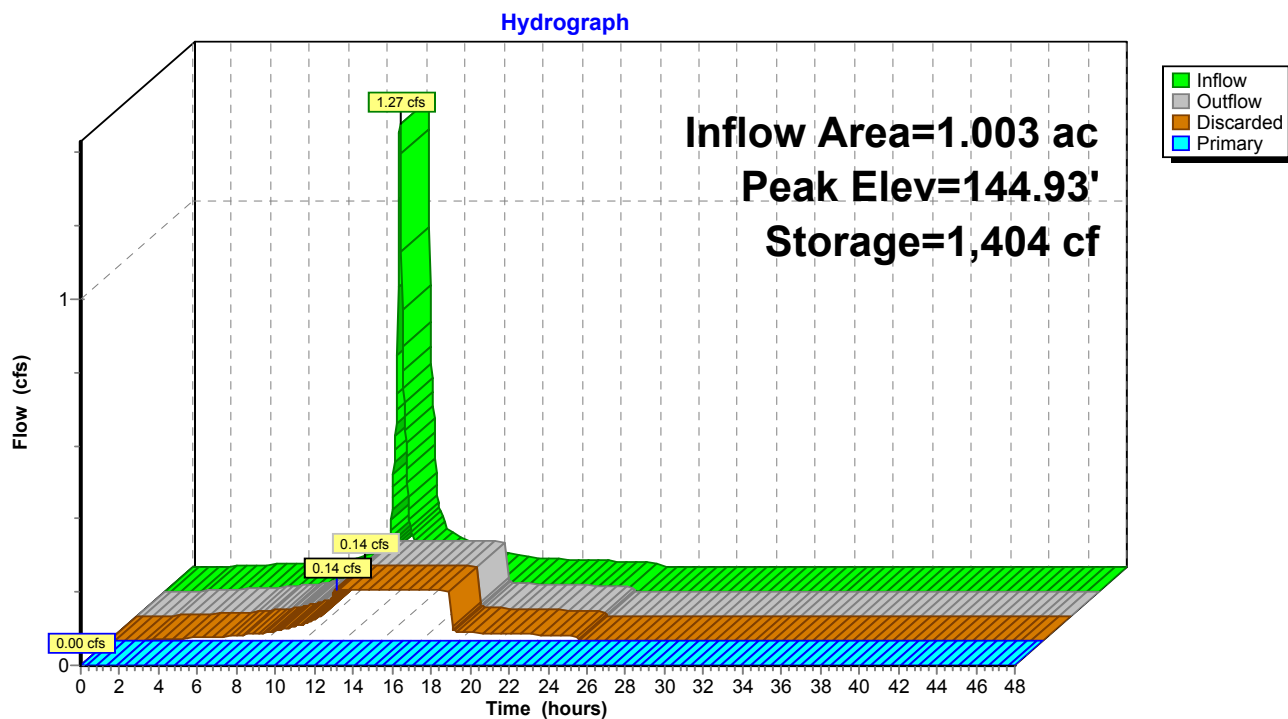
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### Pond P-3: Cultec Infiltration System



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**Summary for Pond P-4: ACF R-Tank SD Infiltration System**

Inflow Area = 0.052 ac, 78.10% Impervious, Inflow Depth = 1.86" for 2-Year event  
 Inflow = 0.10 cfs @ 12.10 hrs, Volume= 0.008 af  
 Outflow = 0.02 cfs @ 11.85 hrs, Volume= 0.008 af, Atten= 80%, Lag= 0.0 min  
 Discarded = 0.02 cfs @ 11.85 hrs, Volume= 0.008 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs / 3  
 Peak Elev= 138.45' @ 12.55 hrs Surf.Area= 364 sf Storage= 87 cf

Plug-Flow detention time= 24.0 min calculated for 0.008 af (100% of inflow)  
 Center-of-Mass det. time= 24.0 min ( 822.5 - 798.5 )

Volume	Invert	Avail.Storage	Storage Description
#1A	138.00'	234 cf	<b>10.56'W x 34.50'L x 2.04'H Field A</b> 742 cf Overall - 158 cf Embedded = 585 cf x 40.0% Voids
#2A	138.25'	150 cf	<b>ACF R-Tank SD 1 x 65 Inside #1</b> Inside= 15.7"W x 9.4"H => 0.98 sf x 2.35'L = 2.3 cf Outside= 15.7"W x 9.4"H => 1.03 sf x 2.35'L = 2.4 cf 5 Rows of 13 Chambers
		384 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	138.00'	<b>2.410 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'

**Discarded OutFlow** Max=0.02 cfs @ 11.85 hrs HW=138.02' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

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### Pond P-4: ACF R-Tank SD Infiltration System - Chamber Wizard Field A

#### Chamber Model = ACF R-Tank SD 1 (ACF Environmental R-Tank SD)

Inside= 15.7"W x 9.4"H => 0.98 sf x 2.35'L = 2.3 cf

Outside= 15.7"W x 9.4"H => 1.03 sf x 2.35'L = 2.4 cf

13 Chambers/Row x 2.35' Long = 30.50' Row Length +24.0" End Stone x 2 = 34.50' Base Length

5 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 10.56' Base Width

3.0" Base + 9.4" Chamber Height + 12.0" Cover = 2.04' Field Height

65 Chambers x 2.3 cf = 149.7 cf Chamber Storage

65 Chambers x 2.4 cf = 157.6 cf Displacement

742.3 cf Field - 157.6 cf Chambers = 584.7 cf Stone x 40.0% Voids = 233.9 cf Stone Storage

Chamber Storage + Stone Storage = 383.6 cf = 0.009 af

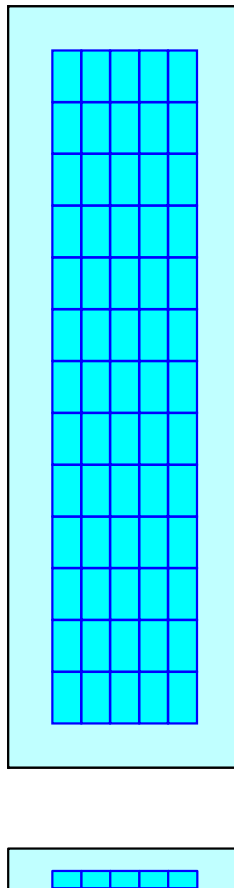
Overall Storage Efficiency = 51.7%

Overall System Size = 34.50' x 10.56' x 2.04'

65 Chambers

27.5 cy Field

21.7 cy Stone



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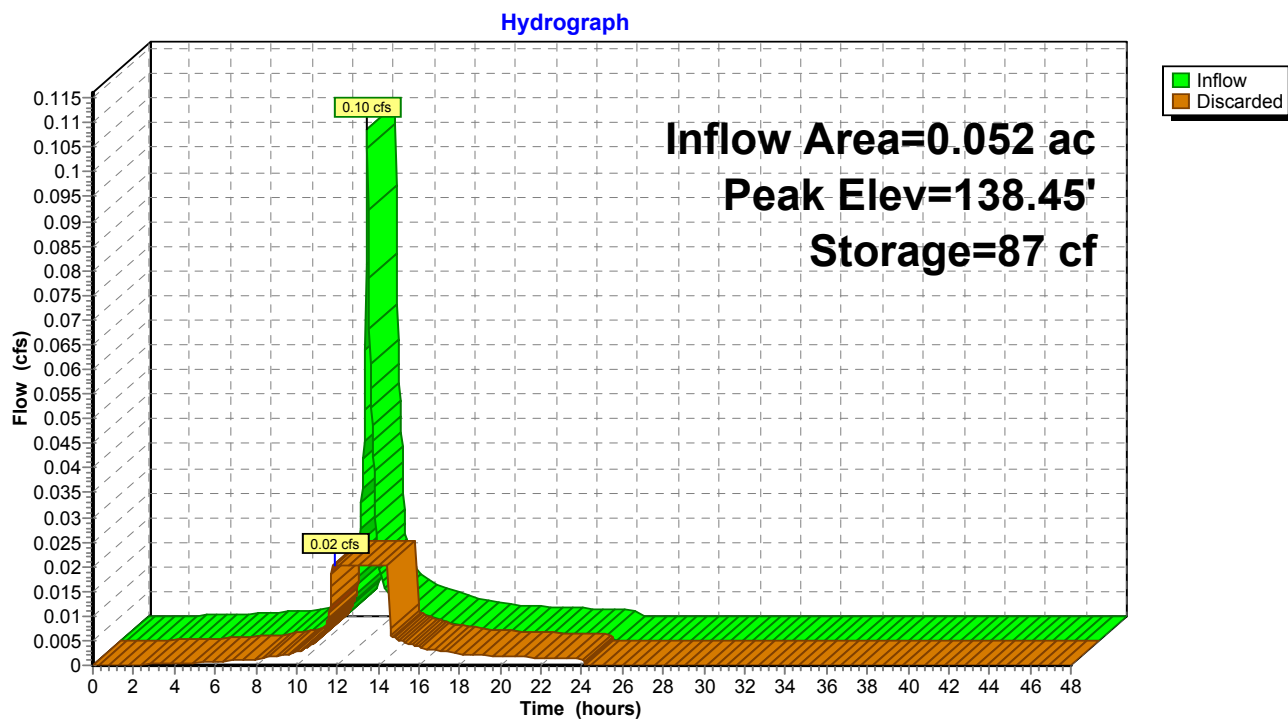
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### Pond P-4: ACF R-Tank SD Infiltration System



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**Summary for Pond P-5: Cultec Infiltration System**

Inflow Area = 0.039 ac, 63.84% Impervious, Inflow Depth = 1.21" for 2-Year event  
 Inflow = 0.05 cfs @ 12.10 hrs, Volume= 0.004 af  
 Outflow = 0.01 cfs @ 12.00 hrs, Volume= 0.004 af, Atten= 84%, Lag= 0.0 min  
 Discarded = 0.01 cfs @ 12.00 hrs, Volume= 0.004 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs / 3  
 Peak Elev= 147.84' @ 12.67 hrs Surf.Area= 155 sf Storage= 50 cf

Plug-Flow detention time= 41.5 min calculated for 0.004 af (100% of inflow)  
 Center-of-Mass det. time= 41.5 min ( 894.4 - 852.9 )

Volume	Invert	Avail.Storage	Storage Description
#1A	147.50'	363 cf	<b>6.33'W x 24.50'L x 3.54'H Field A</b> 550 cf Overall - 168 cf Embedded = 382 cf x 95.0% Voids
#2A	148.00'	168 cf	<b>Cultec R-330XLHD x 3 Inside #1</b> Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 1 rows
		530 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	147.50'	<b>2.410 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'

**Discarded OutFlow** Max=0.01 cfs @ 12.00 hrs HW=147.54' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

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### Pond P-5: Cultec Infiltration System - Chamber Wizard Field A

#### Chamber Model = Cultec R-330XLHD (Cultec Recharger®330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 1 rows

3 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 22.50' Row Length +12.0" End Stone x 2 = 24.50' Base Length

1 Rows x 52.0" Wide + 12.0" Side Stone x 2 = 6.33' Base Width

6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

3 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 1 Rows = 167.6 cf Chamber Storage

549.5 cf Field - 167.6 cf Chambers = 381.9 cf Stone x 95.0% Voids = 362.8 cf Stone Storage

Chamber Storage + Stone Storage = 530.5 cf = 0.012 af

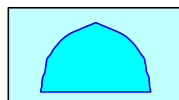
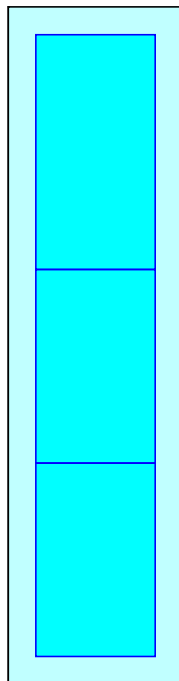
Overall Storage Efficiency = 96.5%

Overall System Size = 24.50' x 6.33' x 3.54'

3 Chambers

20.4 cy Field

14.1 cy Stone



## 217-177 Post Development PSI

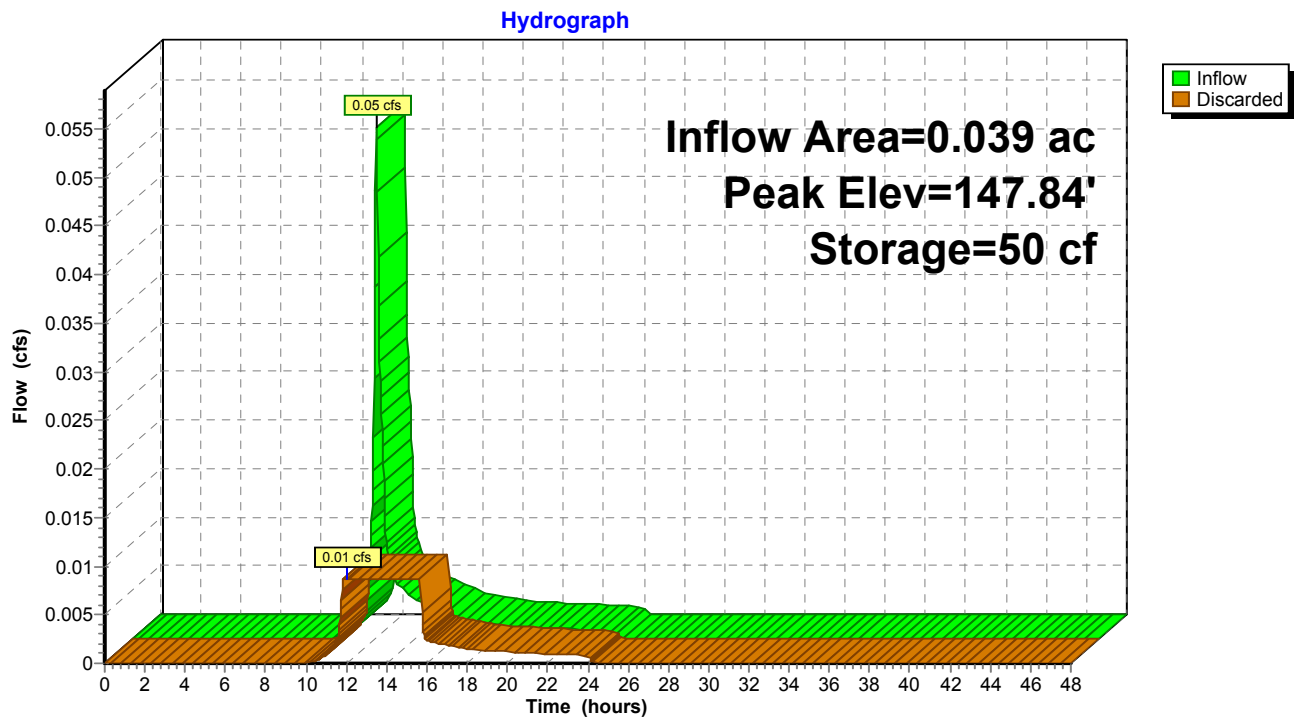
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Type III 24-hr 2-Year Rainfall=3.20"

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### Pond P-5: Cultec Infiltration System



**217-177 Post Development PSI***Type III 24-hr 10-Year Rainfall=4.70"*

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Time span=0.00-48.00 hrs, dt=0.03 hrs, 1601 points x 3  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment1S: OFFSITE NORTHWEST** Runoff Area=78,453 sf 2.48% Impervious Runoff Depth=0.09"  
 Flow Length=434' Tc=16.4 min CN=37 Runoff=0.02 cfs 0.014 af

**Subcatchment1S-1: 1S-1** Runoff Area=6,026 sf 81.48% Impervious Runoff Depth=3.80"  
 Tc=5.0 min CN=92 Runoff=0.60 cfs 0.044 af

**Subcatchment1S-2: 1S-2** Runoff Area=13,675 sf 66.63% Impervious Runoff Depth=2.46"  
 Tc=5.0 min CN=78 Runoff=0.93 cfs 0.064 af

**Subcatchment1S-3: 1S-3** Runoff Area=9,337 sf 26.97% Impervious Runoff Depth=2.46"  
 Flow Length=240' Tc=6.6 min CN=78 Runoff=0.60 cfs 0.044 af

**Subcatchment1S-4: 1S-4** Runoff Area=5,139 sf 15.78% Impervious Runoff Depth=0.48"  
 Flow Length=240' Tc=6.6 min CN=48 Runoff=0.03 cfs 0.005 af

**Subcatchment1S-5: Lower Patio** Runoff Area=791 sf 100.00% Impervious Runoff Depth=4.46"  
 Flow Length=240' Tc=6.6 min CN=98 Runoff=0.08 cfs 0.007 af

**Subcatchment1S-6: Lower Patio** Runoff Area=1,492 sf 66.49% Impervious Runoff Depth=2.46"  
 Flow Length=240' Tc=6.6 min CN=78 Runoff=0.10 cfs 0.007 af

**Subcatchment1S-7: Upper Patios** Runoff Area=1,701 sf 63.84% Impervious Runoff Depth=2.37"  
 Flow Length=240' Tc=6.6 min CN=77 Runoff=0.11 cfs 0.008 af

**Subcatchment1S-8: 1S-8** Runoff Area=287 sf 0.00% Impervious Runoff Depth=0.14"  
 Flow Length=240' Tc=6.6 min CN=39 Runoff=0.00 cfs 0.000 af

**SubcatchmentR-1: ROOF** Runoff Area=7,191 sf 100.00% Impervious Runoff Depth=4.46"  
 Tc=5.0 min CN=98 Runoff=0.78 cfs 0.061 af

**SubcatchmentR-2: ROOF** Runoff Area=13,482 sf 100.00% Impervious Runoff Depth=4.46"  
 Tc=5.0 min CN=98 Runoff=1.46 cfs 0.115 af

**Reach DP-1: DP-1** Inflow=0.03 cfs 0.005 af  
 Outflow=0.03 cfs 0.005 af

**Pond D-1: Area Behind Wall** Peak Elev=148.03' Storage=5 cf Inflow=0.02 cfs 0.014 af  
 Outflow=0.02 cfs 0.014 af

**Pond DMH-1: DMH-2** Peak Elev=146.96' Inflow=0.00 cfs 0.000 af  
 12.0" Round Culvert n=0.013 L=46.0' S=0.0209 '/' Outflow=0.00 cfs 0.000 af

**Pond P-1: ACF R-Tank SD Infiltration System** Peak Elev=138.65' Storage=252 cf Inflow=0.60 cfs 0.057 af  
 Outflow=0.21 cfs 0.057 af

**Pond P-2: Cultec Infiltration System** Peak Elev=148.27' Storage=1,539 cf Inflow=1.71 cfs 0.126 af  
 Discarded=0.27 cfs 0.126 af Primary=0.00 cfs 0.000 af Outflow=0.27 cfs 0.126 af

## 217-177 Post Development PSI

Type III 24-hr 10-Year Rainfall=4.70"

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**Pond P-3: Cultec Infiltration System** Peak Elev=145.59' Storage=2,748 cf Inflow=2.04 cfs 0.159 af  
Discarded=0.14 cfs 0.159 af Primary=0.00 cfs 0.000 af Outflow=0.14 cfs 0.159 af

**Pond P-4: ACF R-Tank SD Infiltration System** Peak Elev=138.88' Storage=198 cf Inflow=0.18 cfs 0.014 af  
Outflow=0.02 cfs 0.014 af

**Pond P-5: Cultec Infiltration System** Peak Elev=148.42' Storage=137 cf Inflow=0.11 cfs 0.008 af  
Outflow=0.01 cfs 0.008 af

**Total Runoff Area = 3.158 ac Runoff Volume = 0.369 af Average Runoff Depth = 1.40"**  
**68.86% Pervious = 2.175 ac 31.14% Impervious = 0.983 ac**

**217-177 Post Development PSI**

Type III 24-hr 10-Year Rainfall=4.70"

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**Summary for Subcatchment 1S: OFFSITE NORTHWEST**

Runoff = 0.02 cfs @ 15.15 hrs, Volume= 0.014 af, Depth= 0.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 10-Year Rainfall=4.70"

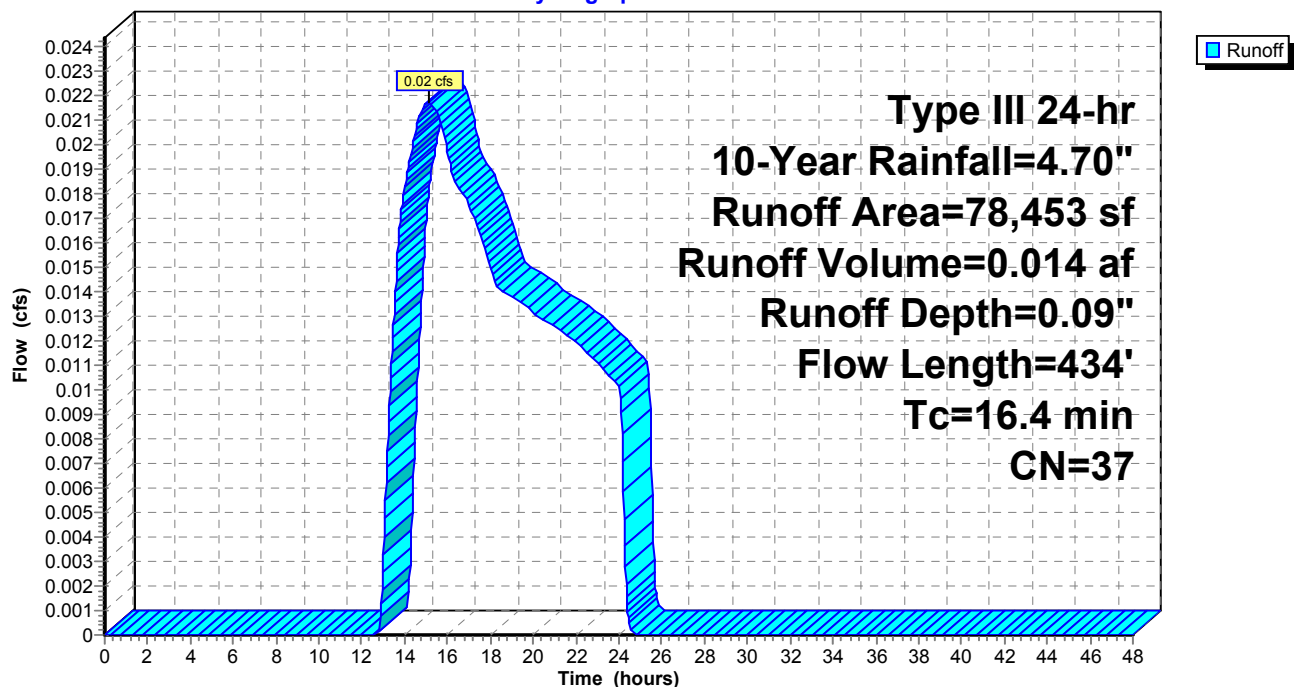
Area (sf)	CN	Description
* 61,141	30	Woods, Good, HSG A (offsite)
* 5,064	96	Gravel surface, HSG A (offsite)
* 8,863	39	>75% Grass cover, Good, HSG A (offsite)
* 1,942	98	Roofs, HSG A (offsite)
1,443	39	>75% Grass cover, Good, HSG A
78,453	37	Weighted Average
76,511		97.52% Pervious Area
1,942		2.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	50	0.0150	0.06		<b>Sheet Flow, SHEET FLOW</b>
					Woods: Light underbrush n= 0.400 P2= 3.20"
2.6	384	0.0236	2.47		<b>Shallow Concentrated Flow, SHALLOW CONC. FLOW</b>
					Unpaved Kv= 16.1 fps
16.4	434	Total			

**Subcatchment 1S: OFFSITE NORTHWEST**

Hydrograph



**217-177 Post Development PSI**

Type III 24-hr 10-Year Rainfall=4.70"

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**Summary for Subcatchment 1S-1: 1S-1**

Runoff = 0.60 cfs @ 12.07 hrs, Volume= 0.044 af, Depth= 3.80"

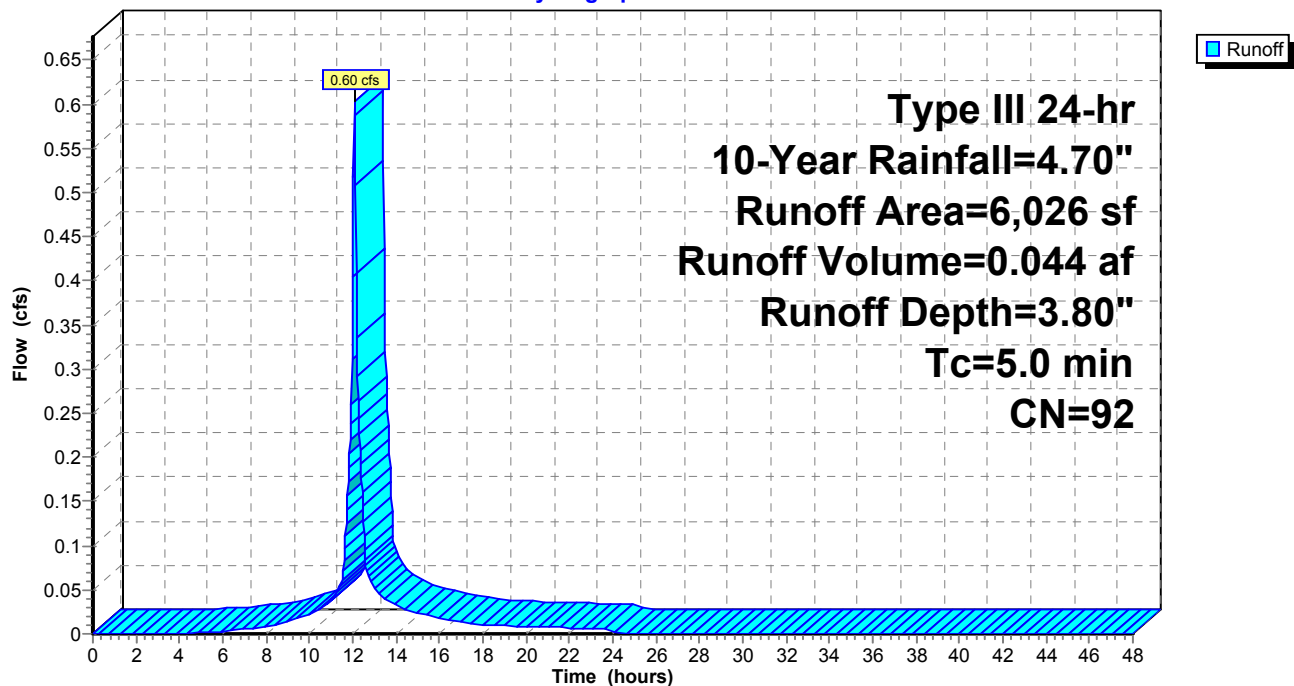
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 10-Year Rainfall=4.70"

	Area (sf)	CN	Description
*	1,116	64	Permeable pavers, HSG A
	3,665	98	Paved parking, HSG A
*	401	98	Patio above, HSG A
*	552	98	Wall, HSG A
*	292	98	Walk, HSG A
	6,026	92	Weighted Average
	1,116		18.52% Pervious Area
	4,910		81.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry, direct

**Subcatchment 1S-1: 1S-1**

Hydrograph



**217-177 Post Development PSI**

Type III 24-hr 10-Year Rainfall=4.70"

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**Summary for Subcatchment 1S-2: 1S-2**

Runoff = 0.93 cfs @ 12.08 hrs, Volume= 0.064 af, Depth= 2.46"

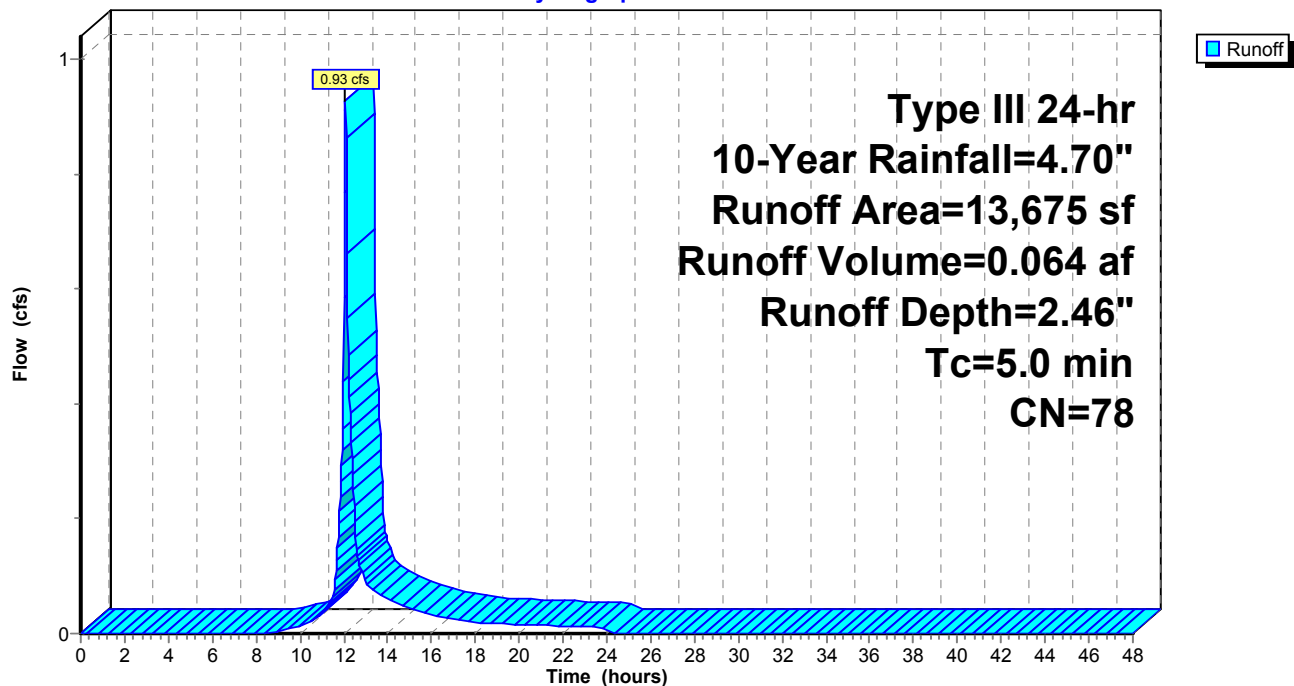
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
4,564	39	>75% Grass cover, Good, HSG A
8,635	98	Paved parking, HSG A
* 226	98	Wall, HSG A
* 250	98	Bluestone patio, HSG A
13,675	78	Weighted Average
4,564		33.37% Pervious Area
9,111		66.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry, direct

**Subcatchment 1S-2: 1S-2**

Hydrograph



**217-177 Post Development PSI**

Type III 24-hr 10-Year Rainfall=4.70"

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**Summary for Subcatchment 1S-3: 1S-3**

Runoff = 0.60 cfs @ 12.10 hrs, Volume= 0.044 af, Depth= 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 10-Year Rainfall=4.70"

	Area (sf)	CN	Description
*	1,256	64	Permeable pavers fire lane, HSG A
*	592	98	Wall, HSG A
*	243	98	Patio above, HSG A
*	1,053	64	Permeable patio, HSG A
*	509	98	Walk, HSG A
*	1,174	98	Area above garage, HSG A
	2,468	74	>75% Grass cover, Good, HSG C
	2,042	76	Gravel roads, HSG A
	9,337	78	Weighted Average
	6,819		73.03% Pervious Area
	2,518		26.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		<b>Sheet Flow, sheet</b>
					Grass: Short n= 0.150 P2= 3.20"
1.0	190	0.0370	3.10		<b>Shallow Concentrated Flow, conc.</b>
					Unpaved Kv= 16.1 fps
6.6	240	Total			

## 217-177 Post Development PSI

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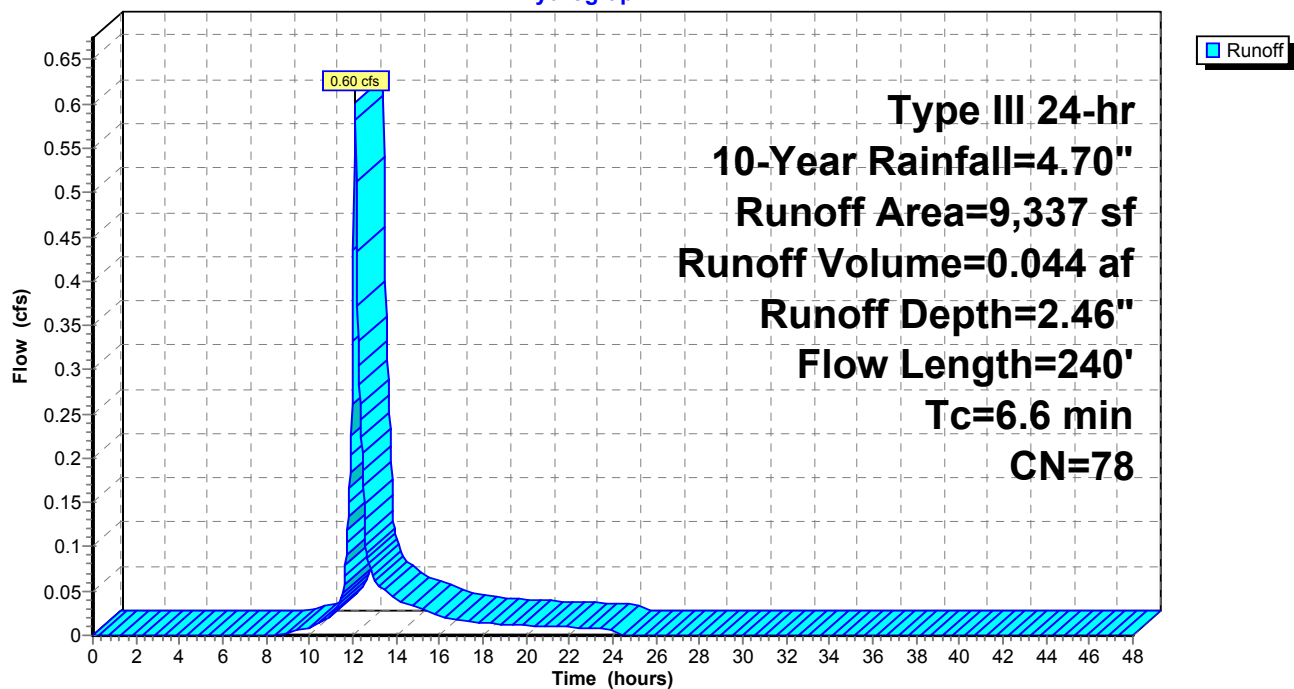
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Type III 24-hr 10-Year Rainfall=4.70"

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### Subcatchment 1S-3: 1S-3

Hydrograph



**217-177 Post Development PSI**

Type III 24-hr 10-Year Rainfall=4.70"

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**Summary for Subcatchment 1S-4: 1S-4**

Runoff = 0.03 cfs @ 12.18 hrs, Volume= 0.005 af, Depth= 0.48"

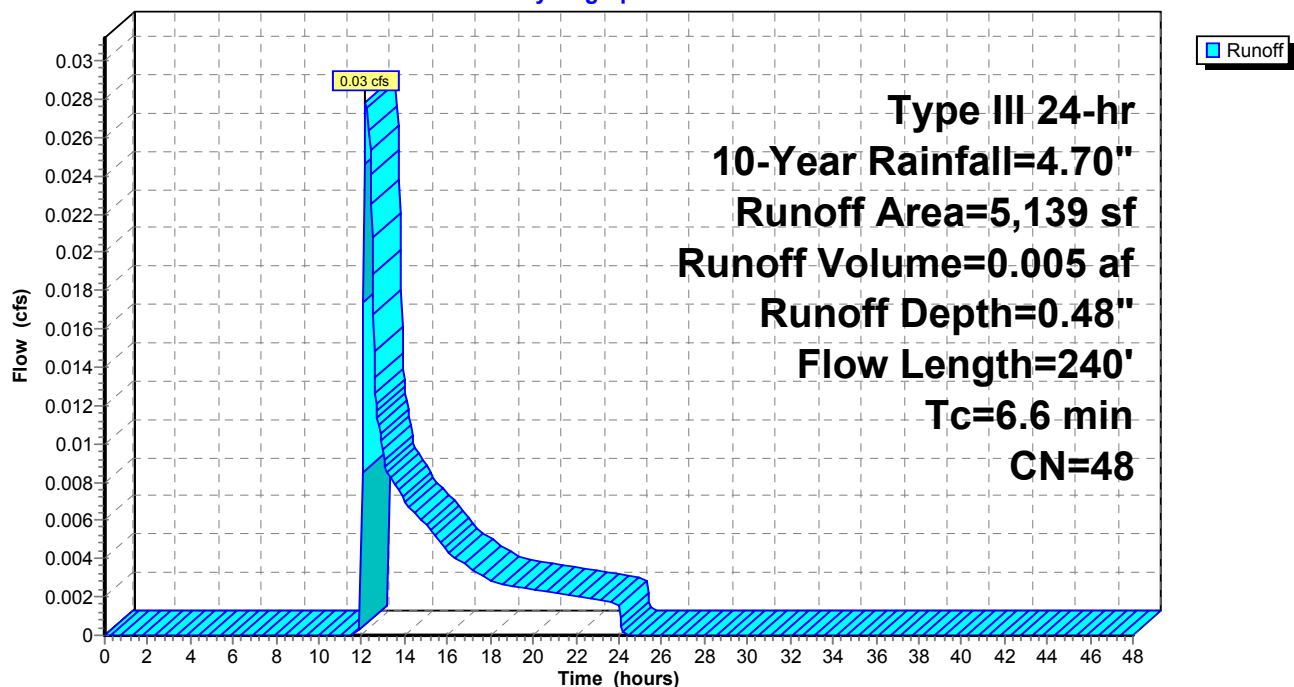
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
4,328	39	>75% Grass cover, Good, HSG A
* 72	98	Wall, HSG A
739	98	Roofs, HSG A
5,139	48	Weighted Average
4,328		84.22% Pervious Area
811		15.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		<b>Sheet Flow, sheet</b>
					Grass: Short n= 0.150 P2= 3.20"
1.0	190	0.0370	3.10		<b>Shallow Concentrated Flow, conc.</b>
					Unpaved Kv= 16.1 fps
6.6	240	Total			

**Subcatchment 1S-4: 1S-4**

Hydrograph



**217-177 Post Development PSI**

Type III 24-hr 10-Year Rainfall=4.70"

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**Summary for Subcatchment 1S-5: Lower Patio**

Runoff = 0.08 cfs @ 12.09 hrs, Volume= 0.007 af, Depth= 4.46"

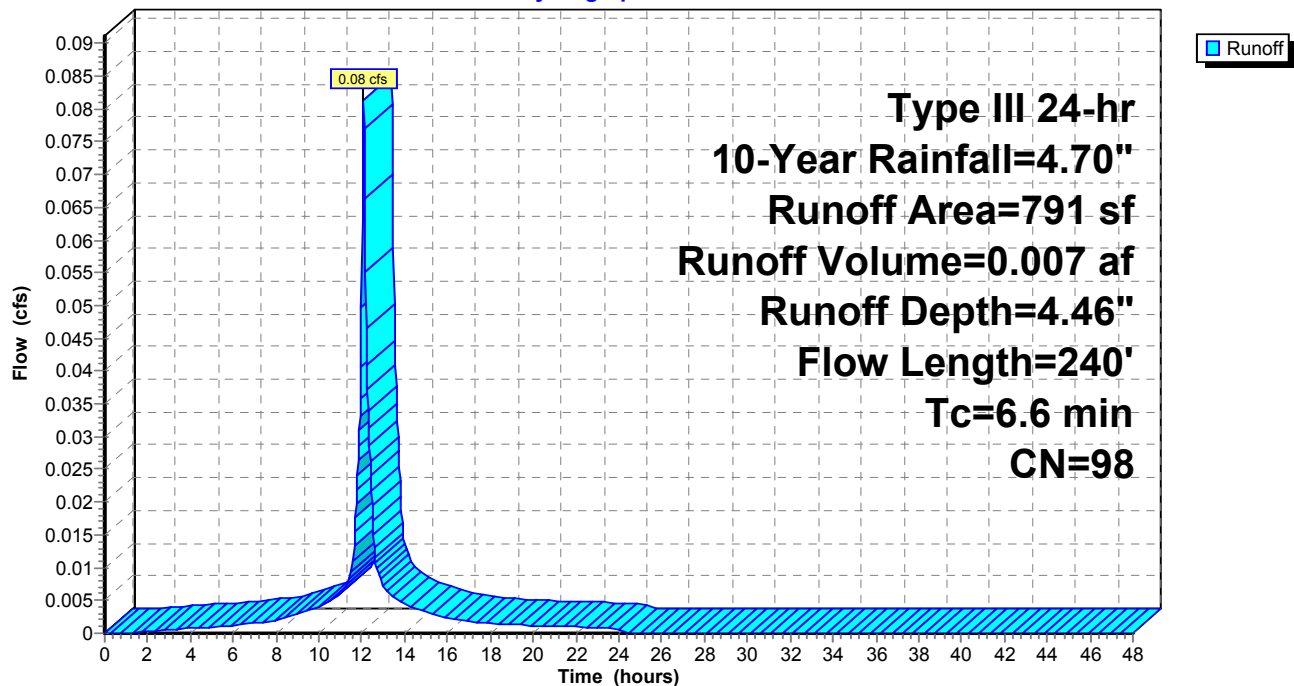
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 10-Year Rainfall=4.70"

	Area (sf)	CN	Description
*	625	98	Bluestone patio, HSG A
*	166	98	Wall, HSG A
	791	98	Weighted Average
	791		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		<b>Sheet Flow, sheet</b>
					Grass: Short n= 0.150 P2= 3.20"
1.0	190	0.0370	3.10		<b>Shallow Concentrated Flow, conc.</b>
					Unpaved Kv= 16.1 fps
6.6	240	Total			

**Subcatchment 1S-5: Lower Patio**

Hydrograph



**217-177 Post Development PSI**

Type III 24-hr 10-Year Rainfall=4.70"

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**Summary for Subcatchment 1S-6: Lower Patio**

Runoff = 0.10 cfs @ 12.10 hrs, Volume= 0.007 af, Depth= 2.46"

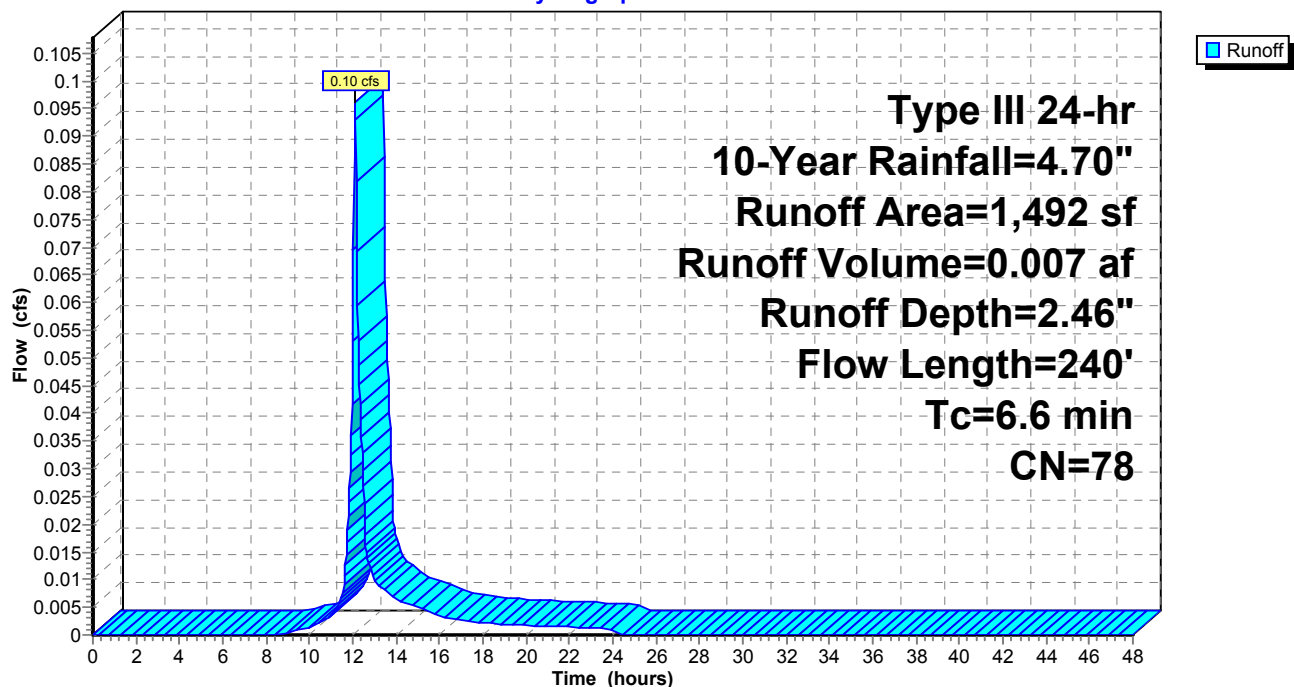
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
500	39	>75% Grass cover, Good, HSG A
* 765	98	Bluestone patio, HSG A
* 120	98	Wall, HSG A
* 9	98	Stepping stones, HSG A
* 98	98	Patio above, HSG A
1,492	78	Weighted Average
500		33.51% Pervious Area
992		66.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		<b>Sheet Flow, sheet</b>
					Grass: Short n= 0.150 P2= 3.20"
1.0	190	0.0370	3.10		<b>Shallow Concentrated Flow, conc.</b>
					Unpaved Kv= 16.1 fps
6.6	240	Total			

**Subcatchment 1S-6: Lower Patio**

Hydrograph



**217-177 Post Development PSI**

Type III 24-hr 10-Year Rainfall=4.70"

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**Summary for Subcatchment 1S-7: Upper Patios**

Runoff = 0.11 cfs @ 12.10 hrs, Volume= 0.008 af, Depth= 2.37"

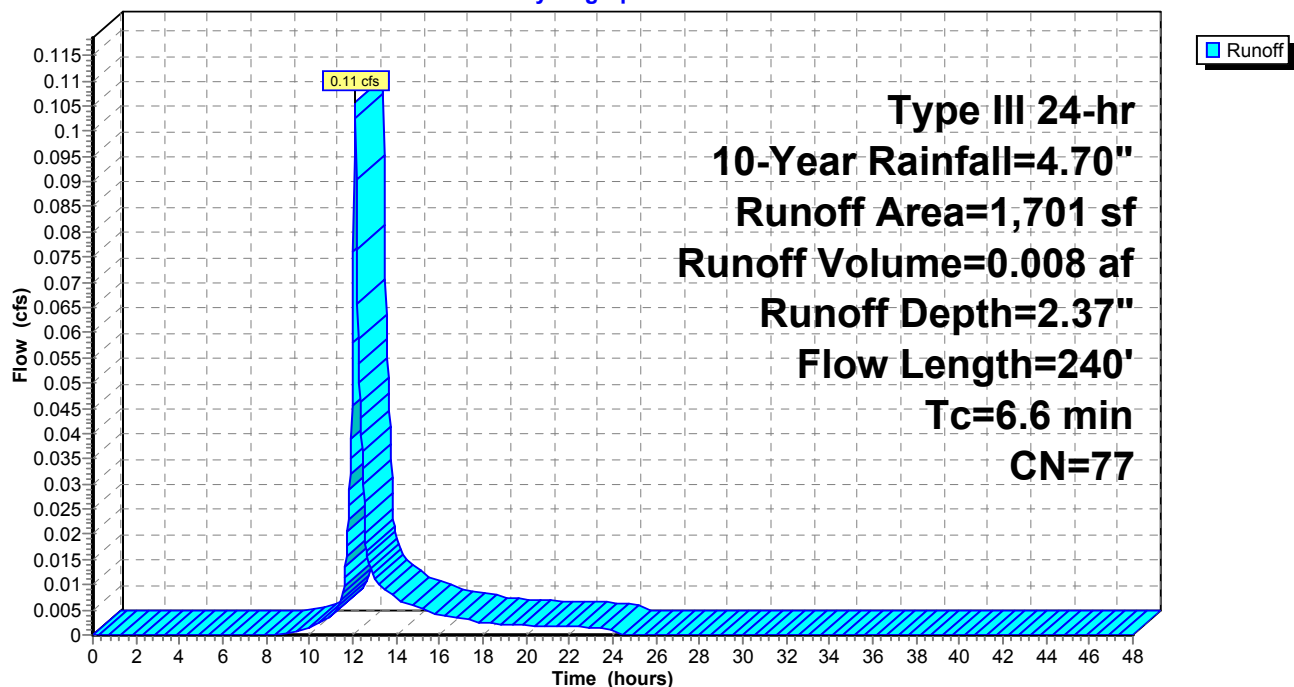
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
615	39	>75% Grass cover, Good, HSG A
* 73	98	Wall, HSG A
* 30	98	Bluestone patio, HSG A
* 970	98	Patio above, HSG A
* 13	98	Stepping stones, HSG A
1,701	77	Weighted Average
615		36.16% Pervious Area
1,086		63.84% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		<b>Sheet Flow, sheet</b>
					Grass: Short n= 0.150 P2= 3.20"
1.0	190	0.0370	3.10		<b>Shallow Concentrated Flow, conc.</b>
					Unpaved Kv= 16.1 fps
6.6	240	Total			

**Subcatchment 1S-7: Upper Patios**

Hydrograph



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Type III 24-hr 10-Year Rainfall=4.70"

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**Summary for Subcatchment 1S-8: 1S-8**

Runoff = 0.00 cfs @ 13.77 hrs, Volume= 0.000 af, Depth= 0.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 10-Year Rainfall=4.70"

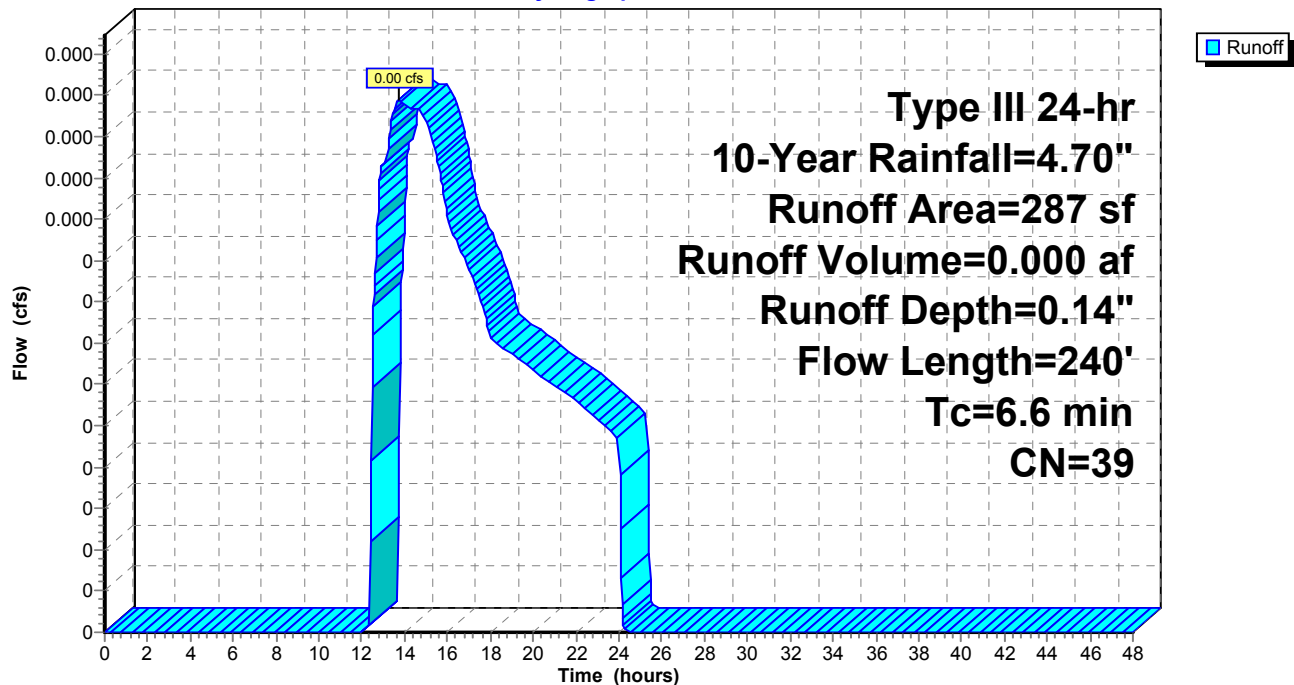
Area (sf)	CN	Description
287	39	>75% Grass cover, Good, HSG A
287		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		<b>Sheet Flow, sheet</b>
1.0	190	0.0370	3.10		Grass: Short n= 0.150 P2= 3.20"
					<b>Shallow Concentrated Flow, conc.</b>
					Unpaved Kv= 16.1 fps
6.6	240	Total			

**Subcatchment 1S-8: 1S-8**

Hydrograph



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Type III 24-hr 10-Year Rainfall=4.70"

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### Summary for Subcatchment R-1: ROOF

Runoff = 0.78 cfs @ 12.07 hrs, Volume= 0.061 af, Depth= 4.46"

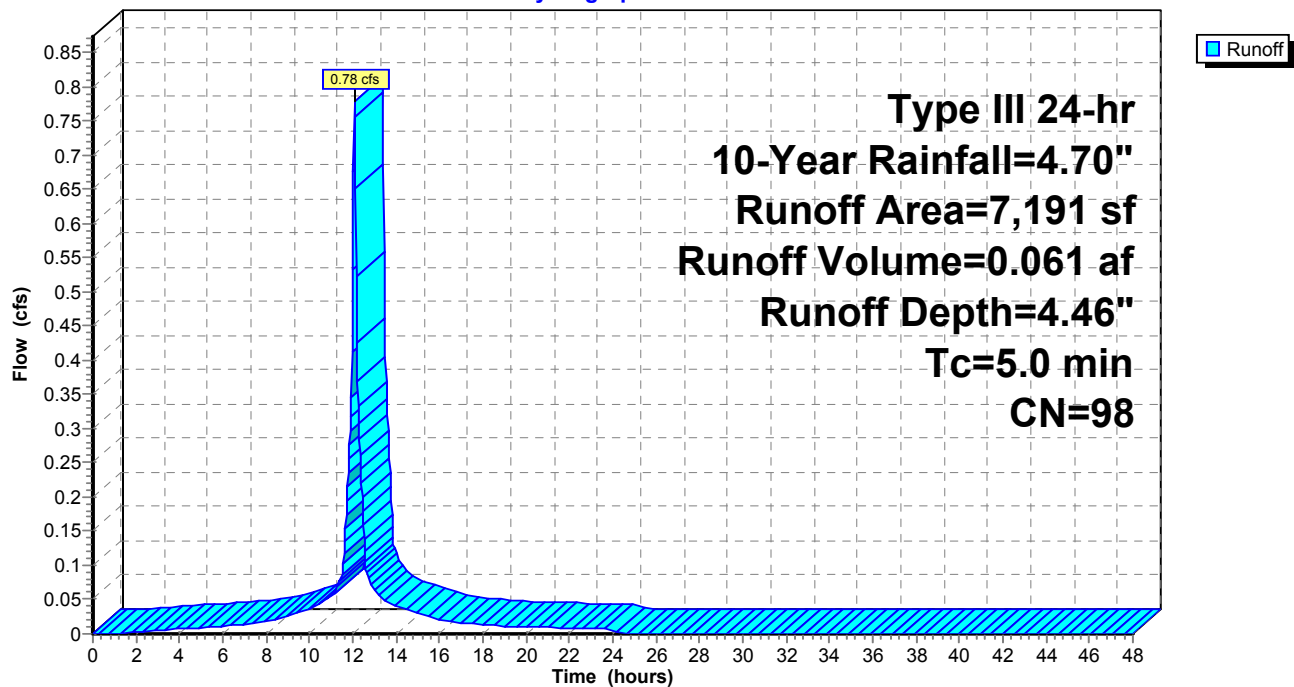
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
7,191	98	Unconnected roofs, HSG A
7,191		100.00% Impervious Area
7,191		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry, direct

### Subcatchment R-1: ROOF

Hydrograph



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Type III 24-hr 10-Year Rainfall=4.70"

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### Summary for Subcatchment R-2: ROOF

Runoff = 1.46 cfs @ 12.07 hrs, Volume= 0.115 af, Depth= 4.46"

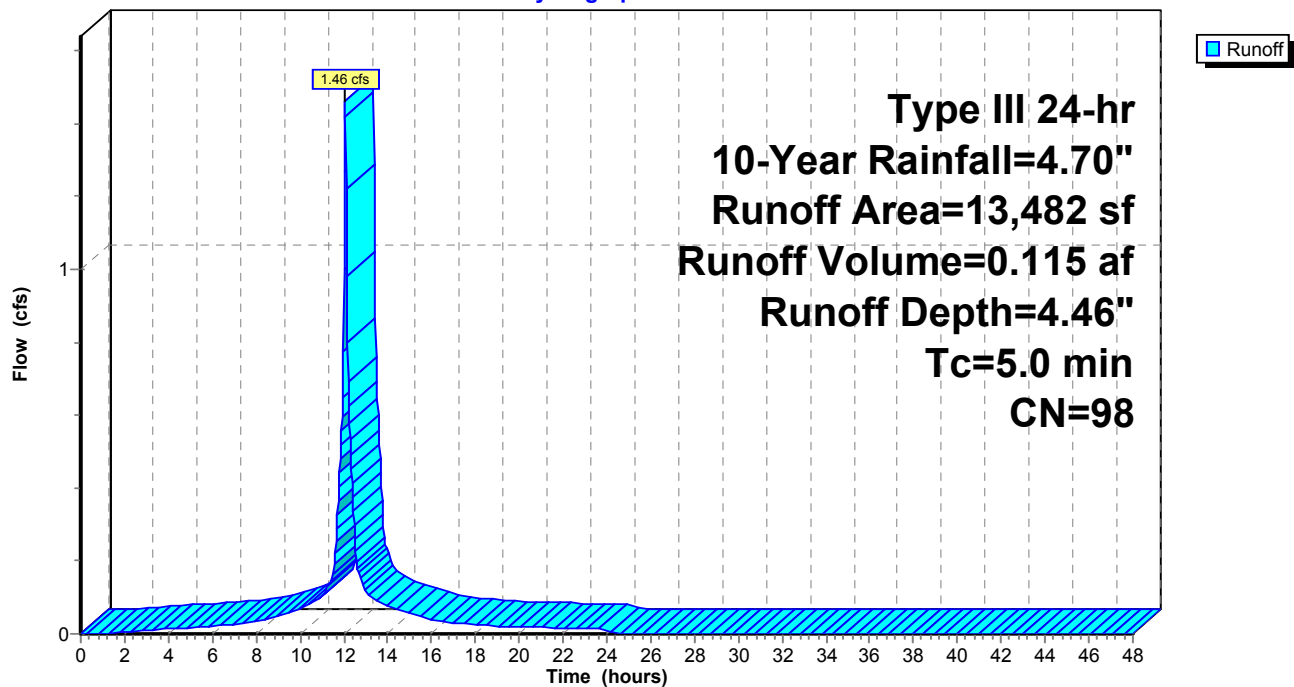
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
13,482	98	Unconnected roofs, HSG A
13,482		100.00% Impervious Area
13,482		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry, direct

### Subcatchment R-2: ROOF

Hydrograph



## 217-177 Post Development PSI

Type III 24-hr 10-Year Rainfall=4.70"

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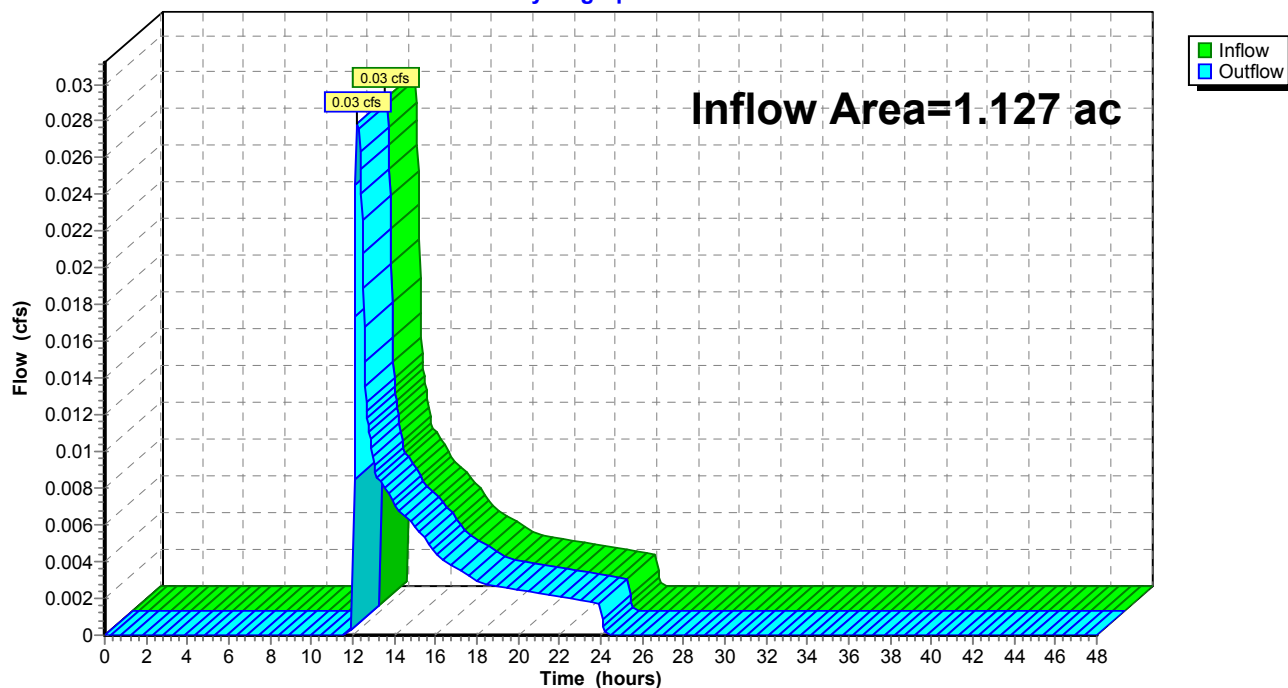
### Summary for Reach DP-1: DP-1

Inflow Area = 1.127 ac, 67.42% Impervious, Inflow Depth = 0.05" for 10-Year event  
Inflow = 0.03 cfs @ 12.18 hrs, Volume= 0.005 af  
Outflow = 0.03 cfs @ 12.18 hrs, Volume= 0.005 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs / 3

### Reach DP-1: DP-1

#### Hydrograph



**217-177 Post Development PSI**

Type III 24-hr 10-Year Rainfall=4.70"

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**Summary for Pond D-1: Area Behind Wall**

Inflow Area = 1.801 ac, 2.48% Impervious, Inflow Depth = 0.09" for 10-Year event  
 Inflow = 0.02 cfs @ 15.15 hrs, Volume= 0.014 af  
 Outflow = 0.02 cfs @ 15.18 hrs, Volume= 0.014 af, Atten= 0%, Lag= 2.0 min  
 Primary = 0.02 cfs @ 15.18 hrs, Volume= 0.014 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs / 3  
 Peak Elev= 148.03' @ 15.18 hrs Surf.Area= 185 sf Storage= 5 cf

Plug-Flow detention time= 4.0 min calculated for 0.014 af (100% of inflow)  
 Center-of-Mass det. time= 4.1 min ( 1,088.9 - 1,084.8 )

Volume	Invert	Avail.Storage	Storage Description
#1	148.00'	1,496 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
148.00	173	0	0
149.00	637	405	405
150.00	1,545	1,091	1,496

Device	Routing	Invert	Outlet Devices
#1	Primary	148.00'	<b>2.0" Horiz. Orifice/Grate X 3.00</b> C= 0.600 Limited to weir flow at low heads

**Primary OutFlow** Max=0.02 cfs @ 15.18 hrs HW=148.03' TW=138.20' (Dynamic Tailwater)  
 ↑ **1=Orifice/Grate** (Weir Controls 0.02 cfs @ 0.53 fps)

## 217-177 Post Development PSI

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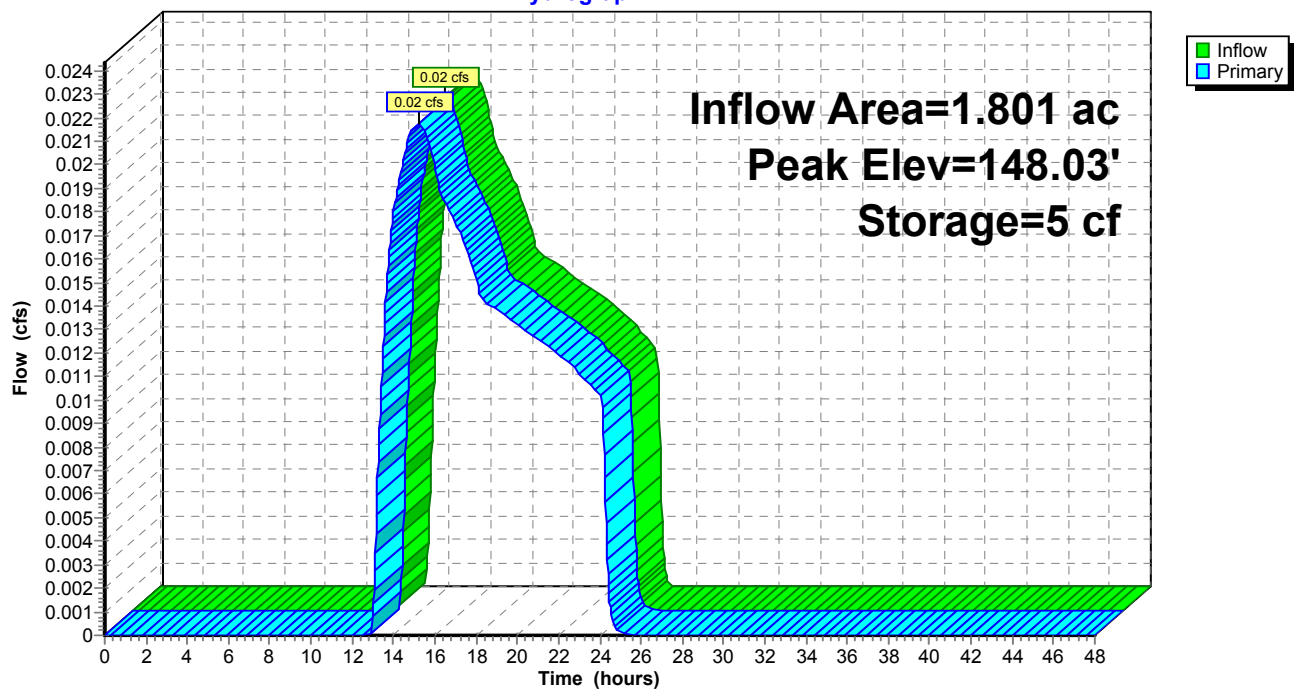
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Type III 24-hr 10-Year Rainfall=4.70"

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### Pond D-1: Area Behind Wall

Hydrograph



## 217-177 Post Development PSI

Type III 24-hr 10-Year Rainfall=4.70"

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### Summary for Pond DMH-1: DMH-2

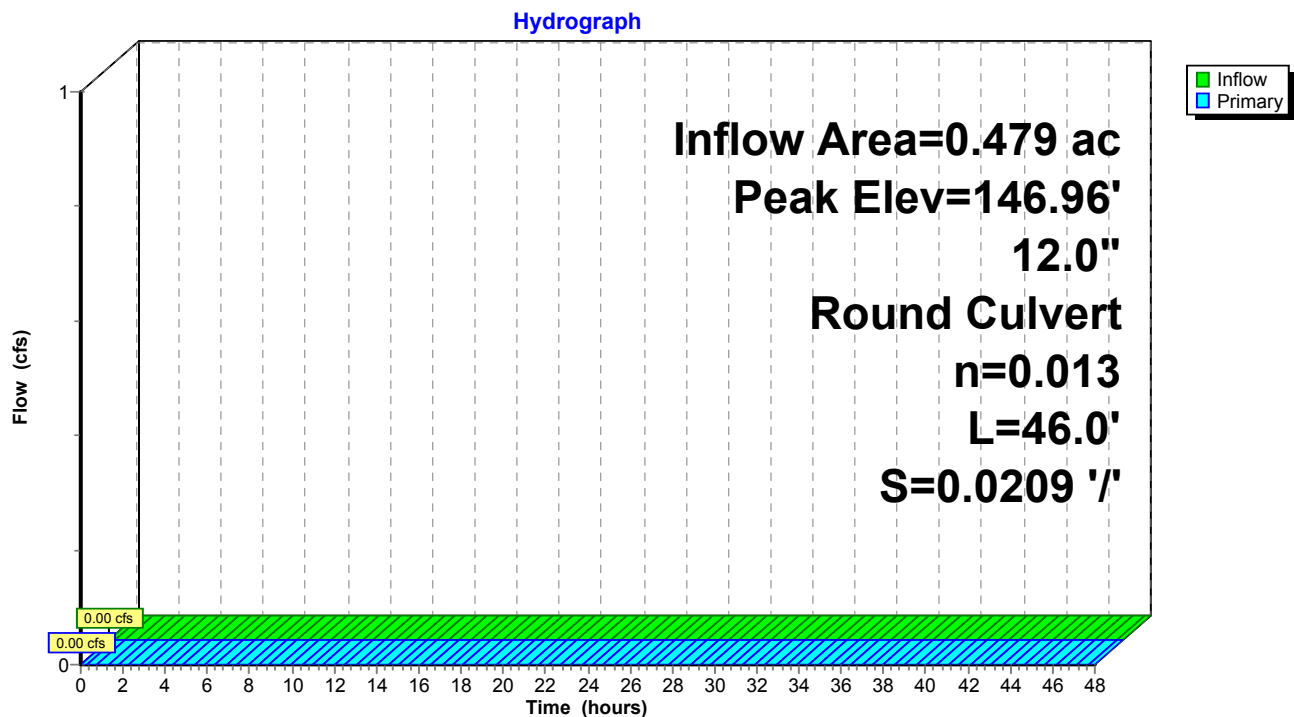
Inflow Area = 0.479 ac, 78.13% Impervious, Inflow Depth = 0.00" for 10-Year event  
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min  
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs / 3  
Peak Elev= 146.96' @ 0.00 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	146.96'	<b>12.0" Round Culvert</b> L= 46.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 146.96' / 146.00' S= 0.0209 '/ Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=146.96' TW=144.00' (Dynamic Tailwater)  
↑1=Culvert ( Controls 0.00 cfs)

### Pond DMH-1: DMH-2



**217-177 Post Development PSI**

Type III 24-hr 10-Year Rainfall=4.70"

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**Summary for Pond P-1: ACF R-Tank SD Infiltration System**

Inflow Area = 1.939 ac, 8.11% Impervious, Inflow Depth = 0.36" for 10-Year event  
 Inflow = 0.60 cfs @ 12.07 hrs, Volume= 0.057 af  
 Outflow = 0.21 cfs @ 11.94 hrs, Volume= 0.057 af, Atten= 66%, Lag= 0.0 min  
 Discarded = 0.21 cfs @ 11.94 hrs, Volume= 0.057 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs / 3  
 Peak Elev= 138.65' @ 12.33 hrs Surf.Area= 1,087 sf Storage= 252 cf

Plug-Flow detention time= 4.0 min calculated for 0.057 af (100% of inflow)  
 Center-of-Mass det. time= 4.0 min ( 860.6 - 856.6 )

Volume	Invert	Avail.Storage	Storage Description
#1A	138.20'	664 cf	<b>22.37'W x 48.57'L x 2.12'H Field A</b> 2,304 cf Overall - 645 cf Embedded = 1,660 cf x 40.0% Voids
#2A	138.53'	613 cf	<b>ACF R-Tank SD 1 x 266 Inside #1</b> Inside= 15.7"W x 9.4"H => 0.98 sf x 2.35'L = 2.3 cf Outside= 15.7"W x 9.4"H => 1.03 sf x 2.35'L = 2.4 cf 14 Rows of 19 Chambers
		1,276 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	138.20'	<b>8.270 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'

**Discarded OutFlow** Max=0.21 cfs @ 11.94 hrs HW=138.23' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.21 cfs)

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Type III 24-hr 10-Year Rainfall=4.70"

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### Pond P-1: ACF R-Tank SD Infiltration System - Chamber Wizard Field A

#### Chamber Model = ACF R-Tank SD 1 (ACF Environmental R-Tank SD)

Inside= 15.7"W x 9.4"H => 0.98 sf x 2.35'L = 2.3 cf

Outside= 15.7"W x 9.4"H => 1.03 sf x 2.35'L = 2.4 cf

19 Chambers/Row x 2.35' Long = 44.57' Row Length +24.0" End Stone x 2 = 48.57' Base Length

14 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 22.37' Base Width

4.0" Base + 9.4" Chamber Height + 12.0" Cover = 2.12' Field Height

266 Chambers x 2.3 cf = 612.5 cf Chamber Storage

266 Chambers x 2.4 cf = 644.8 cf Displacement

2,304.5 cf Field - 644.8 cf Chambers = 1,659.7 cf Stone x 40.0% Voids = 663.9 cf Stone Storage

Chamber Storage + Stone Storage = 1,276.4 cf = 0.029 af

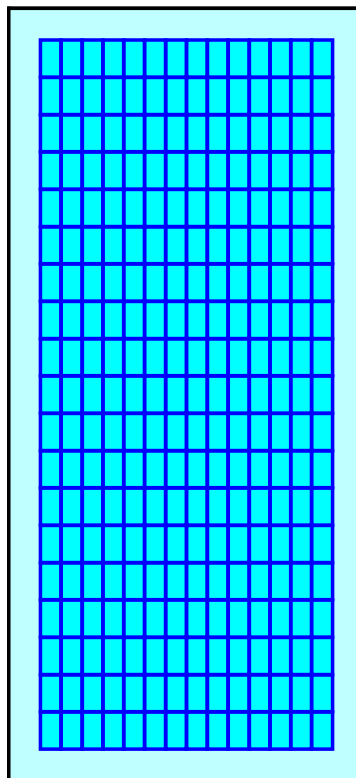
Overall Storage Efficiency = 55.4%

Overall System Size = 48.57' x 22.37' x 2.12'

266 Chambers

85.4 cy Field

61.5 cy Stone



## 217-177 Post Development PSI

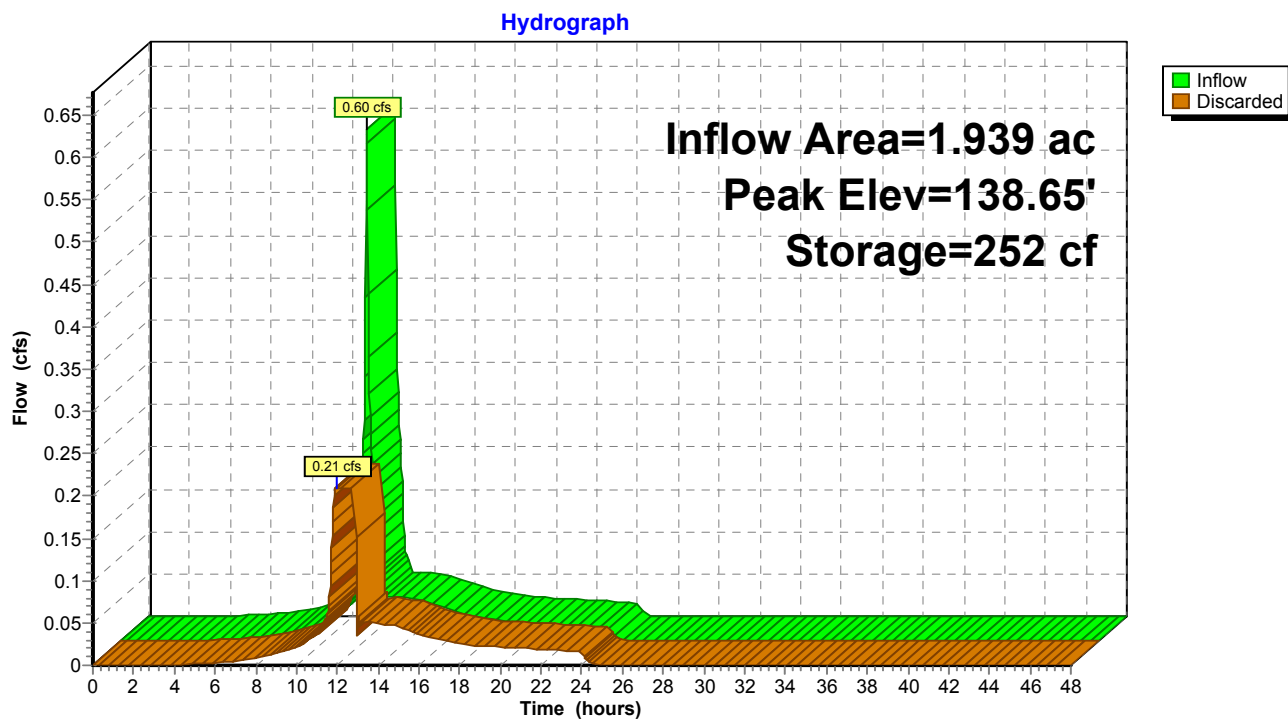
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Type III 24-hr 10-Year Rainfall=4.70"

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### Pond P-1: ACF R-Tank SD Infiltration System



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Type III 24-hr 10-Year Rainfall=4.70"

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**Summary for Pond P-2: Cultec Infiltration System**

Inflow Area = 0.479 ac, 78.13% Impervious, Inflow Depth = 3.15" for 10-Year event  
 Inflow = 1.71 cfs @ 12.07 hrs, Volume= 0.126 af  
 Outflow = 0.27 cfs @ 11.73 hrs, Volume= 0.126 af, Atten= 84%, Lag= 0.0 min  
 Discarded = 0.27 cfs @ 11.73 hrs, Volume= 0.126 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs / 3

Peak Elev= 148.27' @ 12.55 hrs Surf.Area= 1,531 sf Storage= 1,539 cf

Plug-Flow detention time= 35.8 min calculated for 0.126 af (100% of inflow)

Center-of-Mass det. time= 35.8 min ( 825.3 - 789.5 )

Volume	Invert	Avail.Storage	Storage Description
#1A	146.80'	1,317 cf	<b>20.83'W x 73.50'L x 3.54'H Field A</b> 5,423 cf Overall - 2,131 cf Embedded = 3,292 cf x 40.0% Voids
#2A	147.30'	2,131 cf	<b>Cultec R-330XLHD x 40 Inside #1</b> Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 4 rows
		3,448 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	147.13'	<b>12.0" Round 147.13</b> L= 17.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 147.13' / 146.96' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	149.35'	<b>4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)</b>
#3	Discarded	146.80'	<b>Special &amp; User-Defined</b> Head (feet) 0.00 0.10 0.50 1.00 1.50 1.51 1.52 2.00 3.54 Disch. (cfs) 0.000 0.270 0.270 0.270 0.270 0.270 0.000 0.000 0.000

**Discarded OutFlow** Max=0.27 cfs @ 11.73 hrs HW=146.91' (Free Discharge)↑**3=Special & User-Defined** (Custom Controls 0.27 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=146.80' TW=146.96' (Dynamic Tailwater)↑**1=147.13** ( Controls 0.00 cfs)↑**2=Sharp-Crested Rectangular Weir**( Controls 0.00 cfs)

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Type III 24-hr 10-Year Rainfall=4.70"

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### Pond P-2: Cultec Infiltration System - Chamber Wizard Field A

#### Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 4 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

10 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 71.50' Row Length +12.0" End Stone x 2 = 73.50' Base Length

4 Rows x 52.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 20.83' Base Width

6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

40 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 4 Rows = 2,131.0 cf Chamber Storage

5,423.2 cf Field - 2,131.0 cf Chambers = 3,292.2 cf Stone x 40.0% Voids = 1,316.9 cf Stone Storage

Chamber Storage + Stone Storage = 3,447.9 cf = 0.079 af

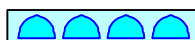
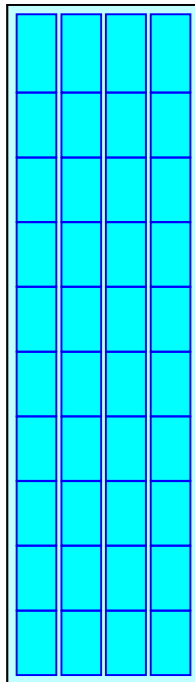
Overall Storage Efficiency = 63.6%

Overall System Size = 73.50' x 20.83' x 3.54'

40 Chambers

200.9 cy Field

121.9 cy Stone



## 217-177 Post Development PSI

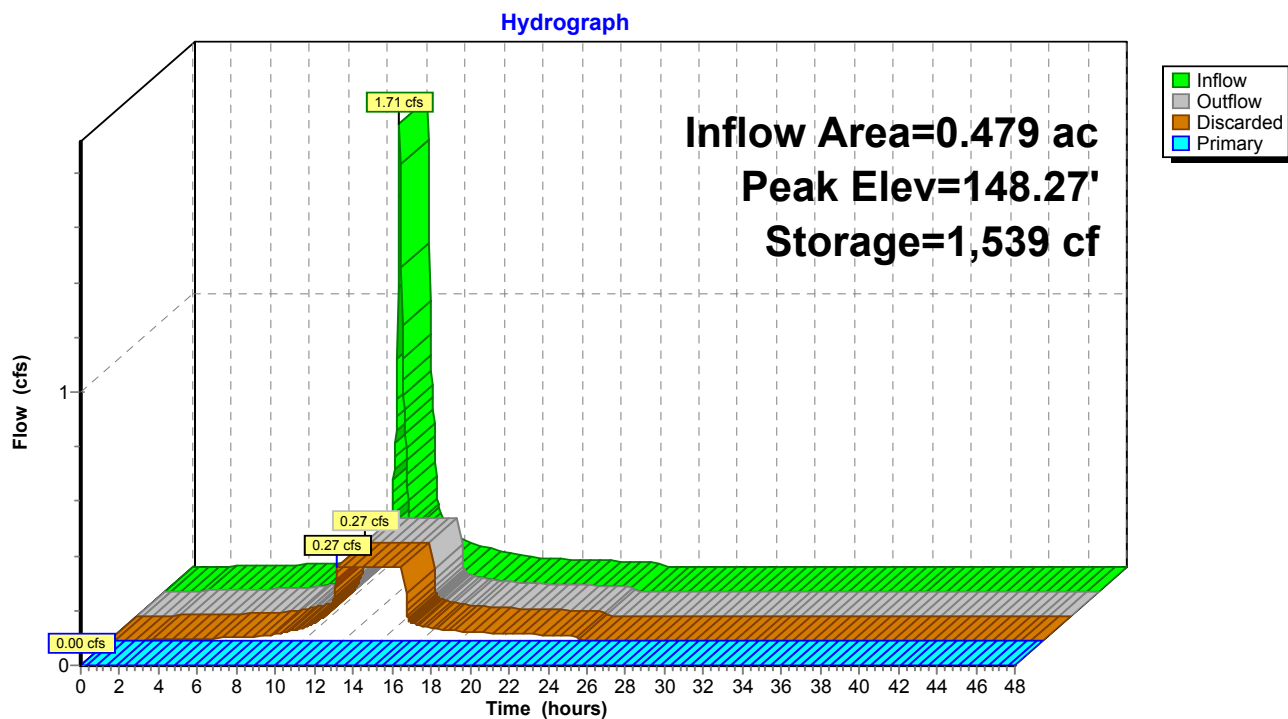
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Type III 24-hr 10-Year Rainfall=4.70"

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### Pond P-2: Cultec Infiltration System



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Type III 24-hr 10-Year Rainfall=4.70"

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**Summary for Pond P-3: Cultec Infiltration System**

Inflow Area = 1.003 ac, 73.94% Impervious, Inflow Depth = 1.90" for 10-Year event  
 Inflow = 2.04 cfs @ 12.08 hrs, Volume= 0.159 af  
 Outflow = 0.14 cfs @ 11.43 hrs, Volume= 0.159 af, Atten= 93%, Lag= 0.0 min  
 Discarded = 0.14 cfs @ 11.43 hrs, Volume= 0.159 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs / 3

Peak Elev= 145.59' @ 13.57 hrs Surf.Area= 2,477 sf Storage= 2,748 cf

Plug-Flow detention time= 159.0 min calculated for 0.159 af (100% of inflow)

Center-of-Mass det. time= 159.0 min ( 929.8 - 770.9 )

Volume	Invert	Avail.Storage	Storage Description
#1A	144.00'	2,095 cf	<b>64.33'W x 38.50'L x 3.54'H Field A</b> 8,772 cf Overall - 3,535 cf Embedded = 5,237 cf x 40.0% Voids
#2A	144.50'	3,535 cf	<b>Cultec R-330XLHD x 65 Inside #1</b> Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 13 rows
		5,630 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	146.50'	<b>4.0" Round Culvert</b> L= 14.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 146.50' / 146.36' S= 0.0100 ' / Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.09 sf
#2	Discarded	144.00'	<b>2.410 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'

**Discarded OutFlow** Max=0.14 cfs @ 11.43 hrs HW=144.04' (Free Discharge)↑**2=Exfiltration** (Exfiltration Controls 0.14 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=144.00' TW=0.00' (Dynamic Tailwater)↑**1=Culvert** ( Controls 0.00 cfs)

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Type III 24-hr 10-Year Rainfall=4.70"

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### Pond P-3: Cultec Infiltration System - Chamber Wizard Field A

#### Chamber Model = Cultec R-330XLHD (Cultec Recharger®330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 13 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

5 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 36.50' Row Length +12.0" End Stone x 2 = 38.50' Base Length

13 Rows x 52.0" Wide + 6.0" Spacing x 12 + 12.0" Side Stone x 2 = 64.33' Base Width

6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

65 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 13 Rows = 3,535.5 cf Chamber Storage

8,772.1 cf Field - 3,535.5 cf Chambers = 5,236.6 cf Stone x 40.0% Voids = 2,094.6 cf Stone Storage

Chamber Storage + Stone Storage = 5,630.1 cf = 0.129 af

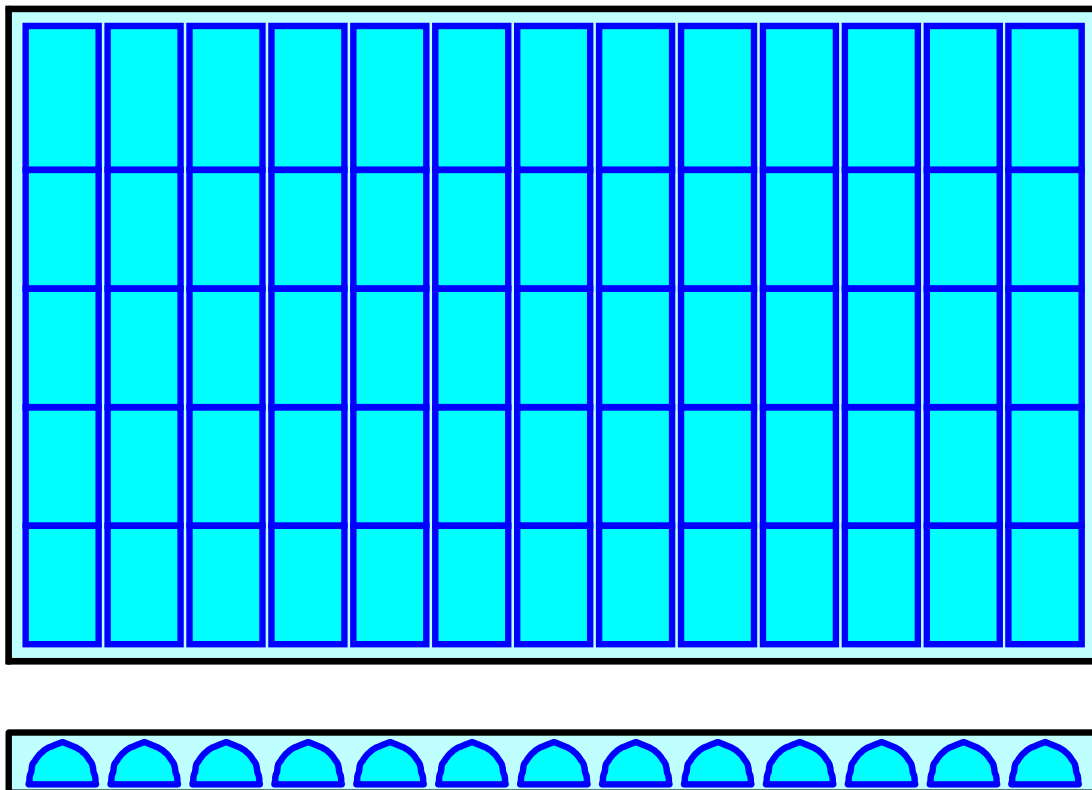
Overall Storage Efficiency = 64.2%

Overall System Size = 38.50' x 64.33' x 3.54'

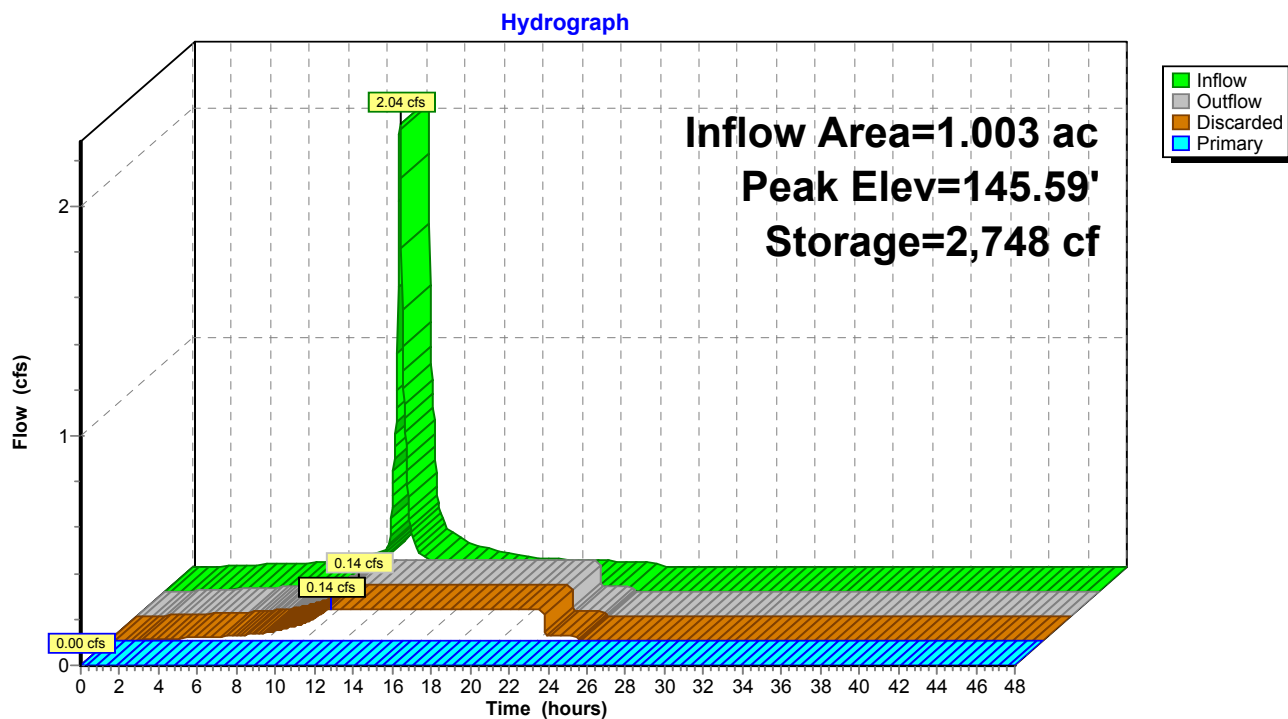
65 Chambers

324.9 cy Field

193.9 cy Stone



### Pond P-3: Cultec Infiltration System



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Type III 24-hr 10-Year Rainfall=4.70"

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**Summary for Pond P-4: ACF R-Tank SD Infiltration System**

Inflow Area = 0.052 ac, 78.10% Impervious, Inflow Depth = 3.15" for 10-Year event  
 Inflow = 0.18 cfs @ 12.10 hrs, Volume= 0.014 af  
 Outflow = 0.02 cfs @ 11.70 hrs, Volume= 0.014 af, Atten= 89%, Lag= 0.0 min  
 Discarded = 0.02 cfs @ 11.70 hrs, Volume= 0.014 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs / 3  
 Peak Elev= 138.88' @ 12.83 hrs Surf.Area= 364 sf Storage= 198 cf

Plug-Flow detention time= 69.2 min calculated for 0.014 af (100% of inflow)  
 Center-of-Mass det. time= 69.2 min ( 860.0 - 790.8 )

Volume	Invert	Avail.Storage	Storage Description
#1A	138.00'	234 cf	<b>10.56'W x 34.50'L x 2.04'H Field A</b> 742 cf Overall - 158 cf Embedded = 585 cf x 40.0% Voids
#2A	138.25'	150 cf	<b>ACF R-Tank SD 1 x 65 Inside #1</b> Inside= 15.7"W x 9.4"H => 0.98 sf x 2.35'L = 2.3 cf Outside= 15.7"W x 9.4"H => 1.03 sf x 2.35'L = 2.4 cf 5 Rows of 13 Chambers
		384 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	138.00'	<b>2.410 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'

**Discarded OutFlow** Max=0.02 cfs @ 11.70 hrs HW=138.02' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

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Type III 24-hr 10-Year Rainfall=4.70"

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### Pond P-4: ACF R-Tank SD Infiltration System - Chamber Wizard Field A

#### Chamber Model = ACF R-Tank SD 1 (ACF Environmental R-Tank SD)

Inside= 15.7"W x 9.4"H => 0.98 sf x 2.35'L = 2.3 cf

Outside= 15.7"W x 9.4"H => 1.03 sf x 2.35'L = 2.4 cf

13 Chambers/Row x 2.35' Long = 30.50' Row Length +24.0" End Stone x 2 = 34.50' Base Length

5 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 10.56' Base Width

3.0" Base + 9.4" Chamber Height + 12.0" Cover = 2.04' Field Height

65 Chambers x 2.3 cf = 149.7 cf Chamber Storage

65 Chambers x 2.4 cf = 157.6 cf Displacement

742.3 cf Field - 157.6 cf Chambers = 584.7 cf Stone x 40.0% Voids = 233.9 cf Stone Storage

Chamber Storage + Stone Storage = 383.6 cf = 0.009 af

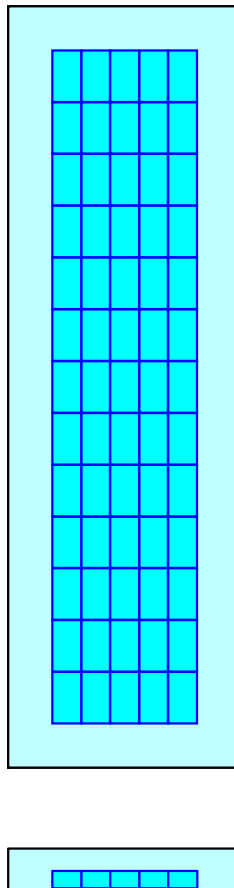
Overall Storage Efficiency = 51.7%

Overall System Size = 34.50' x 10.56' x 2.04'

65 Chambers

27.5 cy Field

21.7 cy Stone



## 217-177 Post Development PSI

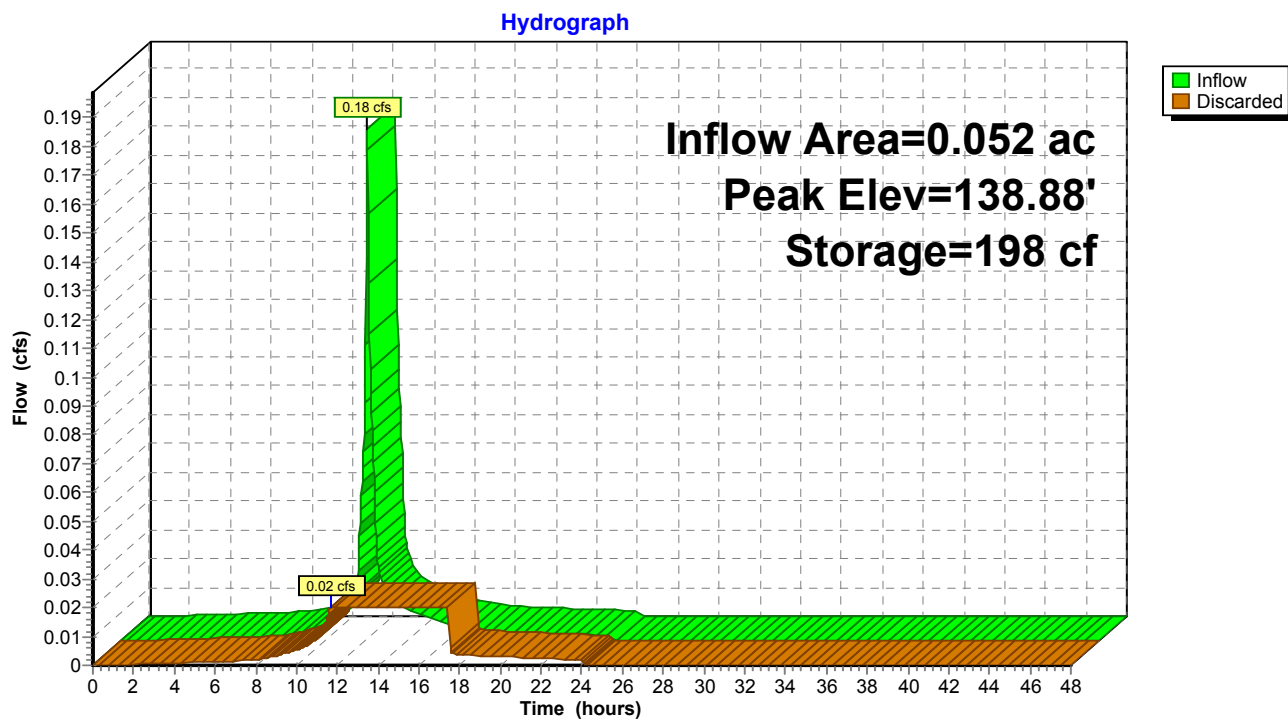
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Type III 24-hr 10-Year Rainfall=4.70"

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### Pond P-4: ACF R-Tank SD Infiltration System



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**Summary for Pond P-5: Cultec Infiltration System**

Inflow Area = 0.039 ac, 63.84% Impervious, Inflow Depth = 2.37" for 10-Year event  
 Inflow = 0.11 cfs @ 12.10 hrs, Volume= 0.008 af  
 Outflow = 0.01 cfs @ 11.79 hrs, Volume= 0.008 af, Atten= 92%, Lag= 0.0 min  
 Discarded = 0.01 cfs @ 11.79 hrs, Volume= 0.008 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs / 3  
 Peak Elev= 148.42' @ 13.57 hrs Surf.Area= 155 sf Storage= 137 cf

Plug-Flow detention time= 144.9 min calculated for 0.008 af (100% of inflow)  
 Center-of-Mass det. time= 144.8 min ( 978.0 - 833.2 )

Volume	Invert	Avail.Storage	Storage Description
#1A	147.50'	363 cf	<b>6.33'W x 24.50'L x 3.54'H Field A</b> 550 cf Overall - 168 cf Embedded = 382 cf x 95.0% Voids
#2A	148.00'	168 cf	<b>Cultec R-330XLHD x 3 Inside #1</b> Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 1 rows
		530 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	147.50'	<b>2.410 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'

**Discarded OutFlow** Max=0.01 cfs @ 11.79 hrs HW=147.54' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

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### Pond P-5: Cultec Infiltration System - Chamber Wizard Field A

#### Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 1 rows

3 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 22.50' Row Length +12.0" End Stone x 2 = 24.50' Base Length

1 Rows x 52.0" Wide + 12.0" Side Stone x 2 = 6.33' Base Width

6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

3 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 1 Rows = 167.6 cf Chamber Storage

549.5 cf Field - 167.6 cf Chambers = 381.9 cf Stone x 95.0% Voids = 362.8 cf Stone Storage

Chamber Storage + Stone Storage = 530.5 cf = 0.012 af

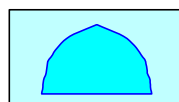
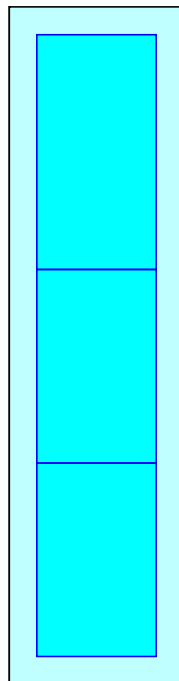
Overall Storage Efficiency = 96.5%

Overall System Size = 24.50' x 6.33' x 3.54'

3 Chambers

20.4 cy Field

14.1 cy Stone



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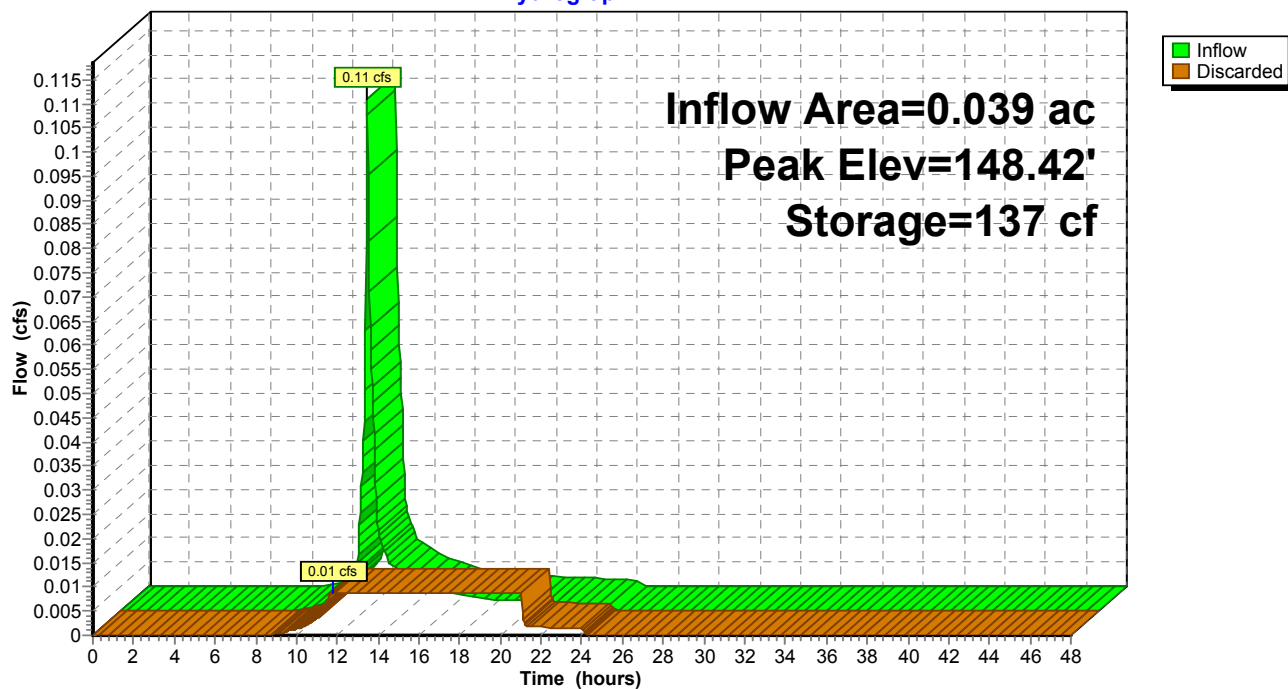
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Type III 24-hr 10-Year Rainfall=4.70"

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### Pond P-5: Cultec Infiltration System

Hydrograph



**217-177 Post Development PSI***Type III 24-hr 25-Year Rainfall=5.50"*

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Time span=0.00-48.00 hrs, dt=0.03 hrs, 1601 points x 3  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment1S: OFFSITE NORTHWEST** Runoff Area=78,453 sf 2.48% Impervious Runoff Depth=0.23"  
 Flow Length=434' Tc=16.4 min CN=37 Runoff=0.07 cfs 0.034 af

**Subcatchment1S-1: 1S-1** Runoff Area=6,026 sf 81.48% Impervious Runoff Depth=4.58"  
 Tc=5.0 min CN=92 Runoff=0.72 cfs 0.053 af

**Subcatchment1S-2: 1S-2** Runoff Area=13,675 sf 66.63% Impervious Runoff Depth=3.14"  
 Tc=5.0 min CN=78 Runoff=1.19 cfs 0.082 af

**Subcatchment1S-3: 1S-3** Runoff Area=9,337 sf 26.97% Impervious Runoff Depth=3.14"  
 Flow Length=240' Tc=6.6 min CN=78 Runoff=0.77 cfs 0.056 af

**Subcatchment1S-4: 1S-4** Runoff Area=5,139 sf 15.78% Impervious Runoff Depth=0.78"  
 Flow Length=240' Tc=6.6 min CN=48 Runoff=0.07 cfs 0.008 af

**Subcatchment1S-5: Lower Patio** Runoff Area=791 sf 100.00% Impervious Runoff Depth=5.26"  
 Flow Length=240' Tc=6.6 min CN=98 Runoff=0.10 cfs 0.008 af

**Subcatchment1S-6: Lower Patio** Runoff Area=1,492 sf 66.49% Impervious Runoff Depth=3.14"  
 Flow Length=240' Tc=6.6 min CN=78 Runoff=0.12 cfs 0.009 af

**Subcatchment1S-7: Upper Patios** Runoff Area=1,701 sf 63.84% Impervious Runoff Depth=3.05"  
 Flow Length=240' Tc=6.6 min CN=77 Runoff=0.14 cfs 0.010 af

**Subcatchment1S-8: 1S-8** Runoff Area=287 sf 0.00% Impervious Runoff Depth=0.31"  
 Flow Length=240' Tc=6.6 min CN=39 Runoff=0.00 cfs 0.000 af

**SubcatchmentR-1: ROOF** Runoff Area=7,191 sf 100.00% Impervious Runoff Depth=5.26"  
 Tc=5.0 min CN=98 Runoff=0.92 cfs 0.072 af

**SubcatchmentR-2: ROOF** Runoff Area=13,482 sf 100.00% Impervious Runoff Depth=5.26"  
 Tc=5.0 min CN=98 Runoff=1.72 cfs 0.136 af

**Reach DP-1: DP-1** Inflow=0.07 cfs 0.009 af  
 Outflow=0.07 cfs 0.009 af

**Pond D-1: Area Behind Wall** Peak Elev=148.06' Storage=10 cf Inflow=0.07 cfs 0.034 af  
 Outflow=0.07 cfs 0.034 af

**Pond DMH-1: DMH-2** Peak Elev=147.16' Inflow=0.17 cfs 0.052 af  
 12.0" Round Culvert n=0.013 L=46.0' S=0.0209 ' /' Outflow=0.17 cfs 0.052 af

**Pond P-1: ACF R-Tank SD Infiltration System** Peak Elev=138.80' Storage=380 cf Inflow=0.72 cfs 0.087 af  
 Outflow=0.21 cfs 0.087 af

**Pond P-2: Cultec Infiltration System** Peak Elev=149.40' Storage=2,808 cf Inflow=2.10 cfs 0.155 af  
 Discarded=0.27 cfs 0.040 af Primary=0.17 cfs 0.052 af Outflow=0.27 cfs 0.091 af

## 217-177 Post Development PSI

Type III 24-hr 25-Year Rainfall=5.50"

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**Pond P-3: Cultec Infiltration System** Peak Elev=146.57' Storage=4,538 cf Inflow=2.45 cfs 0.243 af  
Discarded=0.14 cfs 0.242 af Primary=0.01 cfs 0.001 af Outflow=0.15 cfs 0.243 af

**Pond P-4: ACF R-Tank SD Infiltration System** Peak Elev=139.23' Storage=265 cf Inflow=0.22 cfs 0.017 af  
Outflow=0.02 cfs 0.017 af

**Pond P-5: Cultec Infiltration System** Peak Elev=148.80' Storage=195 cf Inflow=0.14 cfs 0.010 af  
Outflow=0.01 cfs 0.010 af

**Total Runoff Area = 3.158 ac Runoff Volume = 0.468 af Average Runoff Depth = 1.78"**  
**68.86% Pervious = 2.175 ac 31.14% Impervious = 0.983 ac**

**217-177 Post Development PSI**

Type III 24-hr 25-Year Rainfall=5.50"

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**Summary for Subcatchment 1S: OFFSITE NORTHWEST**

Runoff = 0.07 cfs @ 12.64 hrs, Volume= 0.034 af, Depth= 0.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 25-Year Rainfall=5.50"

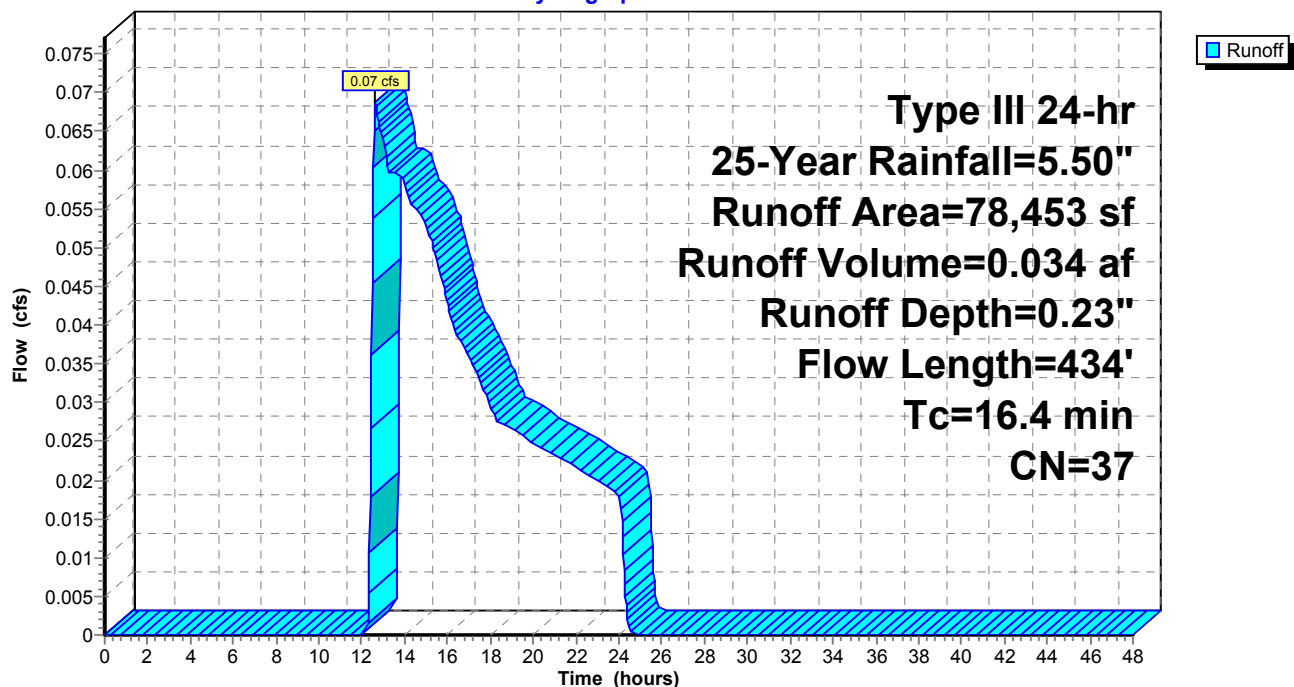
Area (sf)	CN	Description
* 61,141	30	Woods, Good, HSG A (offsite)
* 5,064	96	Gravel surface, HSG A (offsite)
* 8,863	39	>75% Grass cover, Good, HSG A (offsite)
* 1,942	98	Roofs, HSG A (offsite)
1,443	39	>75% Grass cover, Good, HSG A
78,453	37	Weighted Average
76,511		97.52% Pervious Area
1,942		2.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	50	0.0150	0.06		<b>Sheet Flow, SHEET FLOW</b>
					Woods: Light underbrush n= 0.400 P2= 3.20"
2.6	384	0.0236	2.47		<b>Shallow Concentrated Flow, SHALLOW CONC. FLOW</b>
					Unpaved Kv= 16.1 fps
16.4	434	Total			

**Subcatchment 1S: OFFSITE NORTHWEST**

Hydrograph



**217-177 Post Development PSI**

Type III 24-hr 25-Year Rainfall=5.50"

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**Summary for Subcatchment 1S-1: 1S-1**

Runoff = 0.72 cfs @ 12.07 hrs, Volume= 0.053 af, Depth= 4.58"

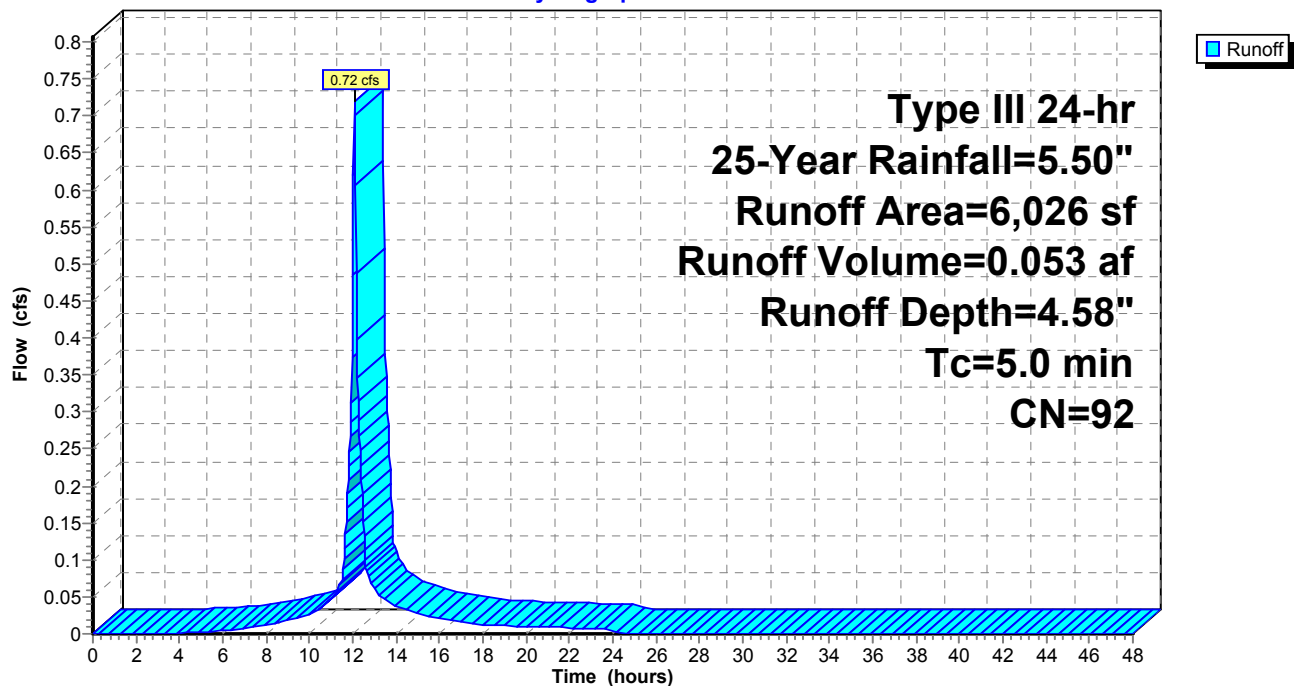
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 25-Year Rainfall=5.50"

	Area (sf)	CN	Description
*	1,116	64	Permeable pavers, HSG A
	3,665	98	Paved parking, HSG A
*	401	98	Patio above, HSG A
*	552	98	Wall, HSG A
*	292	98	Walk, HSG A
	6,026	92	Weighted Average
	1,116		18.52% Pervious Area
	4,910		81.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry, direct

**Subcatchment 1S-1: 1S-1**

Hydrograph



**217-177 Post Development PSI**

Type III 24-hr 25-Year Rainfall=5.50"

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**Summary for Subcatchment 1S-2: 1S-2**

Runoff = 1.19 cfs @ 12.08 hrs, Volume= 0.082 af, Depth= 3.14"

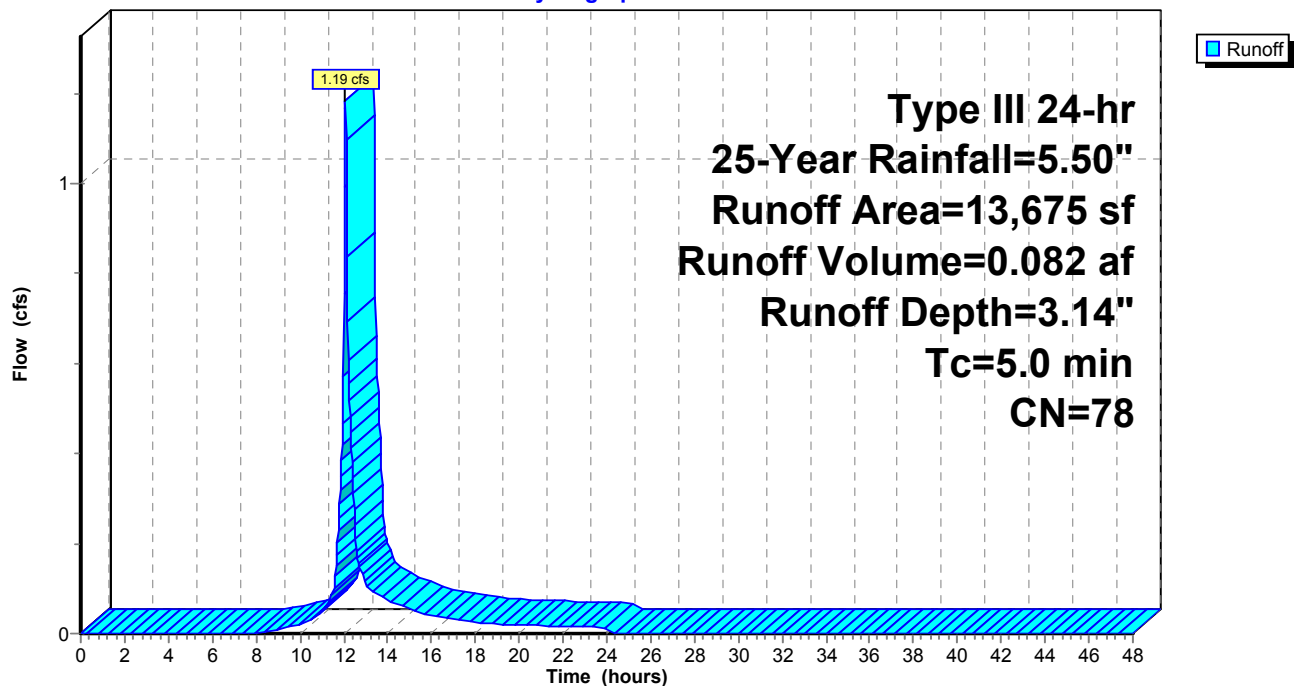
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
4,564	39	>75% Grass cover, Good, HSG A
8,635	98	Paved parking, HSG A
* 226	98	Wall, HSG A
* 250	98	Bluestone patio, HSG A
13,675	78	Weighted Average
4,564		33.37% Pervious Area
9,111		66.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry, direct

**Subcatchment 1S-2: 1S-2**

Hydrograph



**217-177 Post Development PSI**

Type III 24-hr 25-Year Rainfall=5.50"

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**Summary for Subcatchment 1S-3: 1S-3**

Runoff = 0.77 cfs @ 12.10 hrs, Volume= 0.056 af, Depth= 3.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 25-Year Rainfall=5.50"

	Area (sf)	CN	Description
*	1,256	64	Permeable pavers fire lane, HSG A
*	592	98	Wall, HSG A
*	243	98	Patio above, HSG A
*	1,053	64	Permeable patio, HSG A
*	509	98	Walk, HSG A
*	1,174	98	Area above garage, HSG A
	2,468	74	>75% Grass cover, Good, HSG C
	2,042	76	Gravel roads, HSG A
	9,337	78	Weighted Average
	6,819		73.03% Pervious Area
	2,518		26.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		<b>Sheet Flow, sheet</b>
					Grass: Short n= 0.150 P2= 3.20"
1.0	190	0.0370	3.10		<b>Shallow Concentrated Flow, conc.</b>
					Unpaved Kv= 16.1 fps
6.6	240	Total			

## 217-177 Post Development PSI

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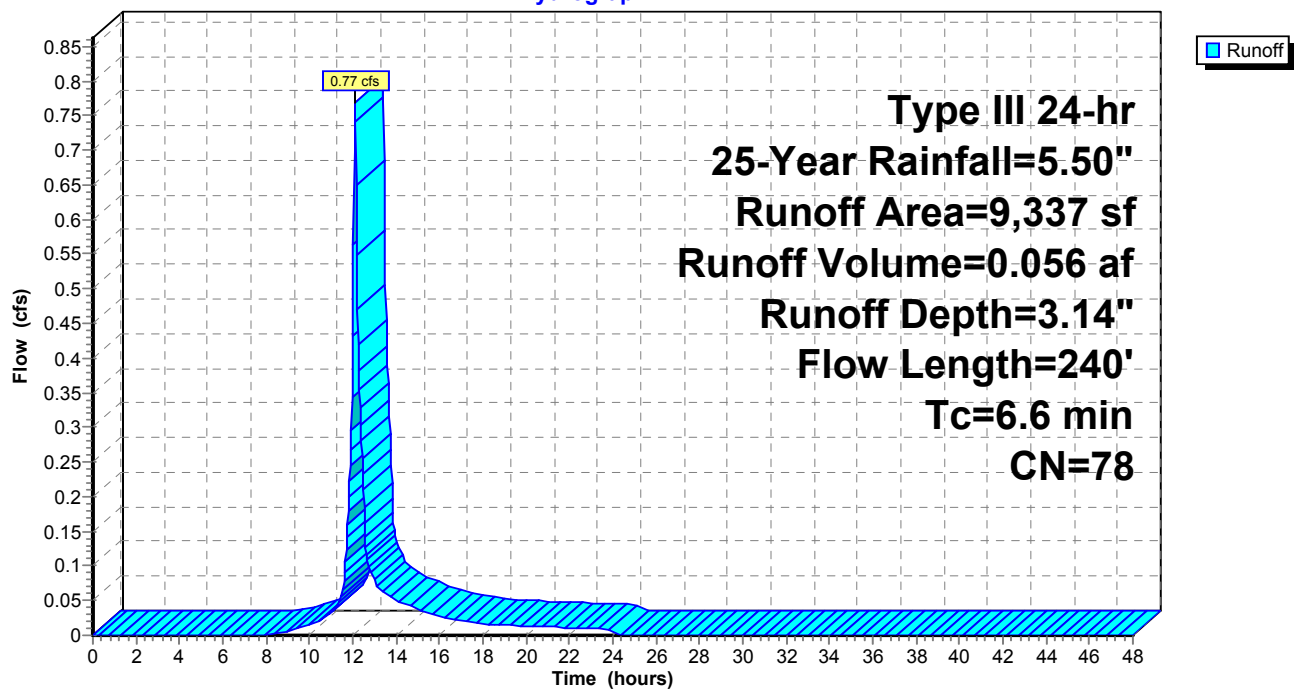
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Type III 24-hr 25-Year Rainfall=5.50"

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### Subcatchment 1S-3: 1S-3

Hydrograph



**217-177 Post Development PSI**

Type III 24-hr 25-Year Rainfall=5.50"

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**Summary for Subcatchment 1S-4: 1S-4**

Runoff = 0.07 cfs @ 12.13 hrs, Volume= 0.008 af, Depth= 0.78"

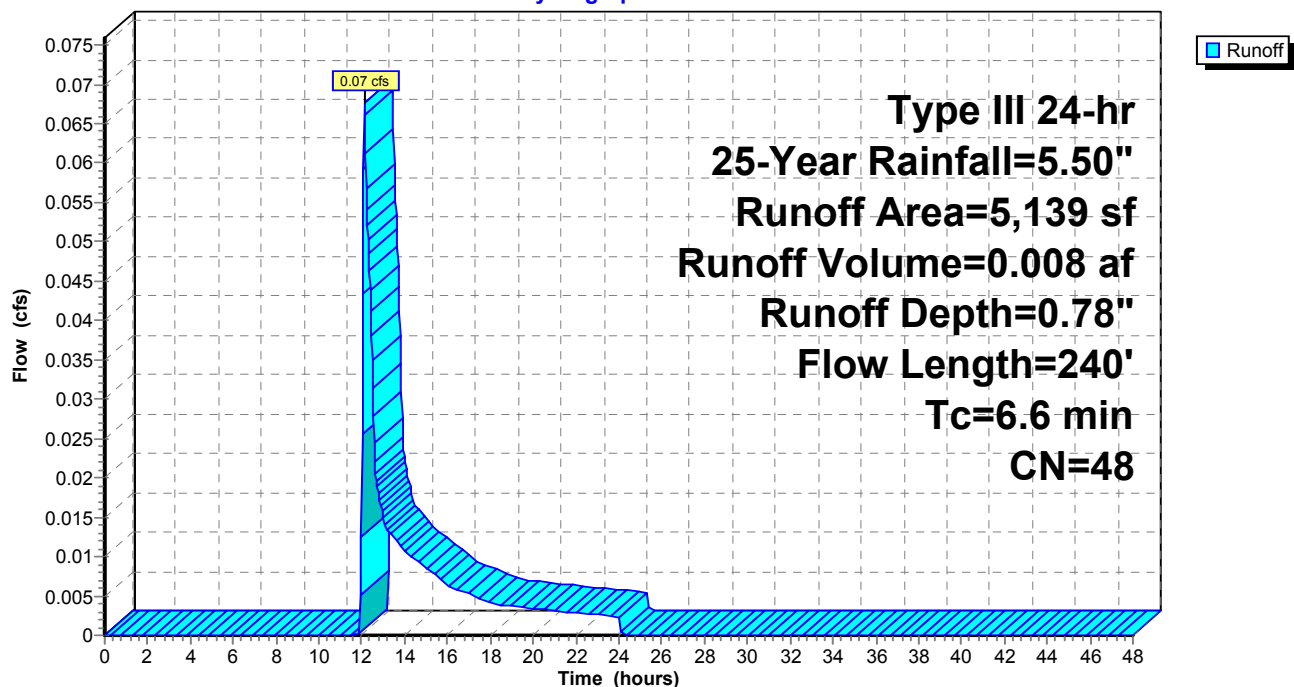
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
4,328	39	>75% Grass cover, Good, HSG A
* 72	98	Wall, HSG A
739	98	Roofs, HSG A
5,139	48	Weighted Average
4,328		84.22% Pervious Area
811		15.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		<b>Sheet Flow, sheet</b>
					Grass: Short n= 0.150 P2= 3.20"
1.0	190	0.0370	3.10		<b>Shallow Concentrated Flow, conc.</b>
					Unpaved Kv= 16.1 fps
6.6	240	Total			

**Subcatchment 1S-4: 1S-4**

Hydrograph



**217-177 Post Development PSI**

Type III 24-hr 25-Year Rainfall=5.50"

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**Summary for Subcatchment 1S-5: Lower Patio**

Runoff = 0.10 cfs @ 12.09 hrs, Volume= 0.008 af, Depth= 5.26"

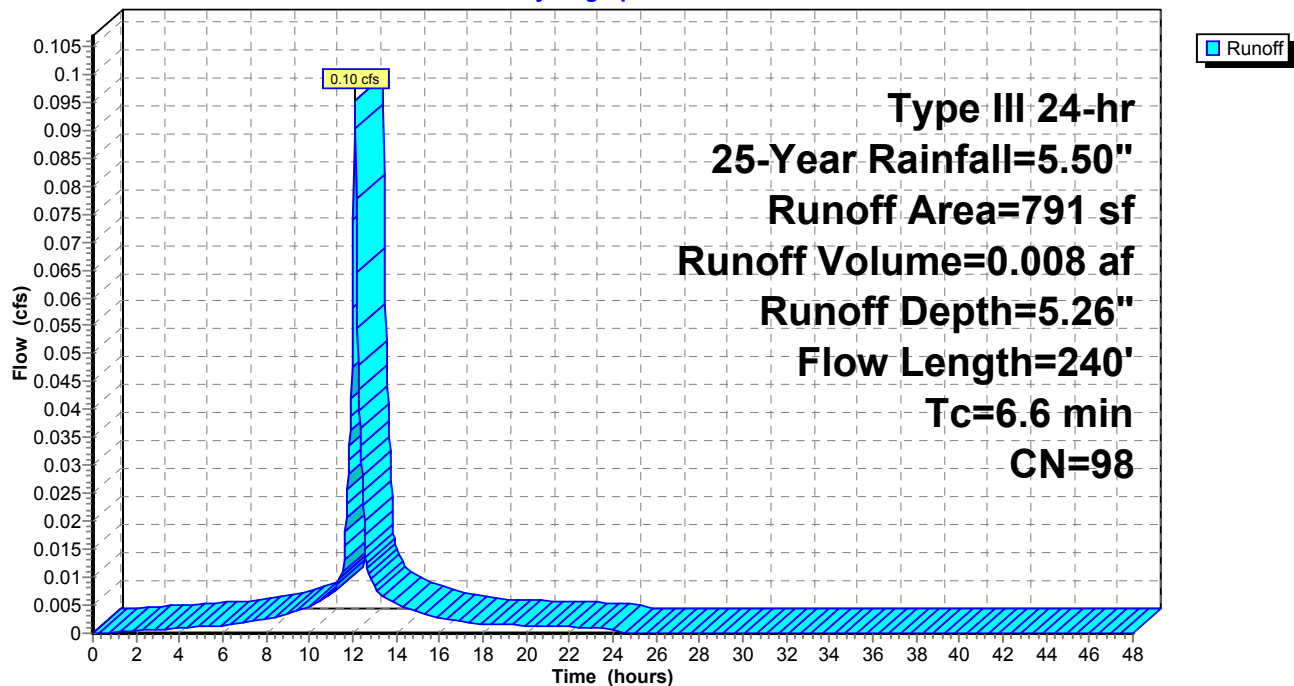
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 25-Year Rainfall=5.50"

	Area (sf)	CN	Description
*	625	98	Bluestone patio, HSG A
*	166	98	Wall, HSG A
	791	98	Weighted Average
	791		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		<b>Sheet Flow, sheet</b>
					Grass: Short n= 0.150 P2= 3.20"
1.0	190	0.0370	3.10		<b>Shallow Concentrated Flow, conc.</b>
					Unpaved Kv= 16.1 fps
6.6	240	Total			

**Subcatchment 1S-5: Lower Patio**

Hydrograph



**217-177 Post Development PSI**

Type III 24-hr 25-Year Rainfall=5.50"

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**Summary for Subcatchment 1S-6: Lower Patio**

Runoff = 0.12 cfs @ 12.10 hrs, Volume= 0.009 af, Depth= 3.14"

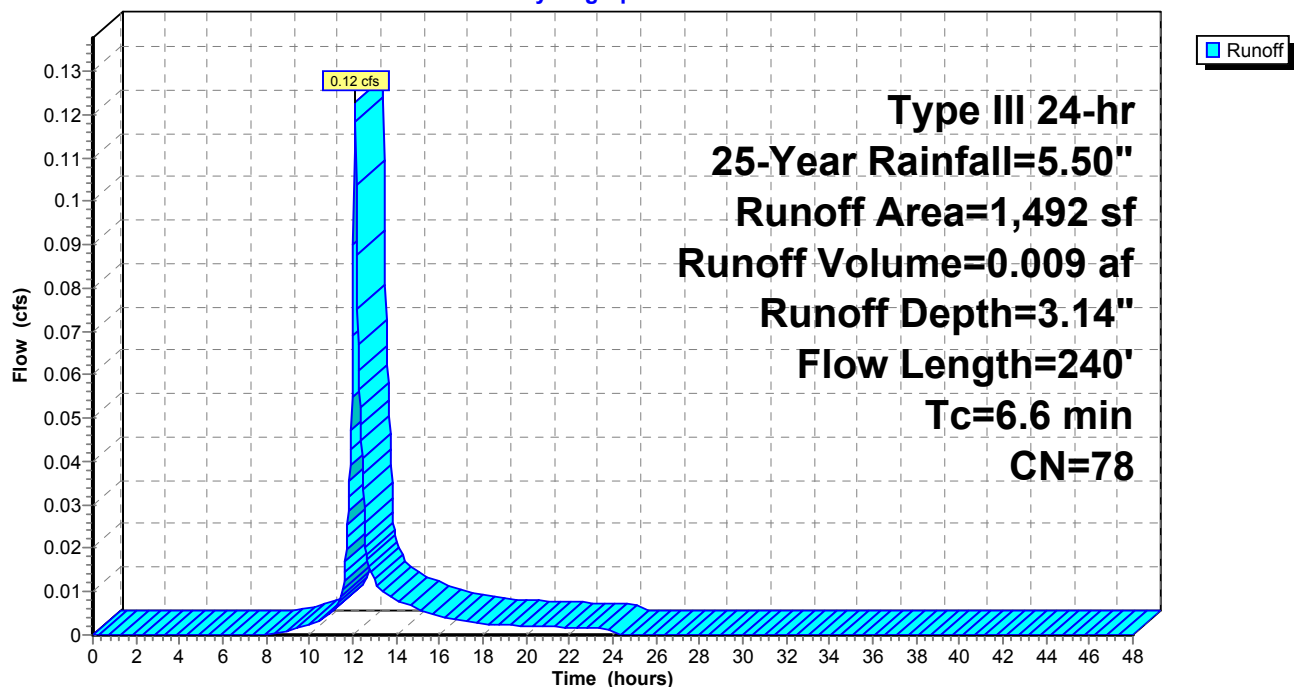
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
500	39	>75% Grass cover, Good, HSG A
* 765	98	Bluestone patio, HSG A
* 120	98	Wall, HSG A
* 9	98	Stepping stones, HSG A
* 98	98	Patio above, HSG A
1,492	78	Weighted Average
500		33.51% Pervious Area
992		66.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		<b>Sheet Flow, sheet</b>
					Grass: Short n= 0.150 P2= 3.20"
1.0	190	0.0370	3.10		<b>Shallow Concentrated Flow, conc.</b>
					Unpaved Kv= 16.1 fps
6.6	240	Total			

**Subcatchment 1S-6: Lower Patio**

Hydrograph



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Type III 24-hr 25-Year Rainfall=5.50"

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**Summary for Subcatchment 1S-7: Upper Patios**

Runoff = 0.14 cfs @ 12.10 hrs, Volume= 0.010 af, Depth= 3.05"

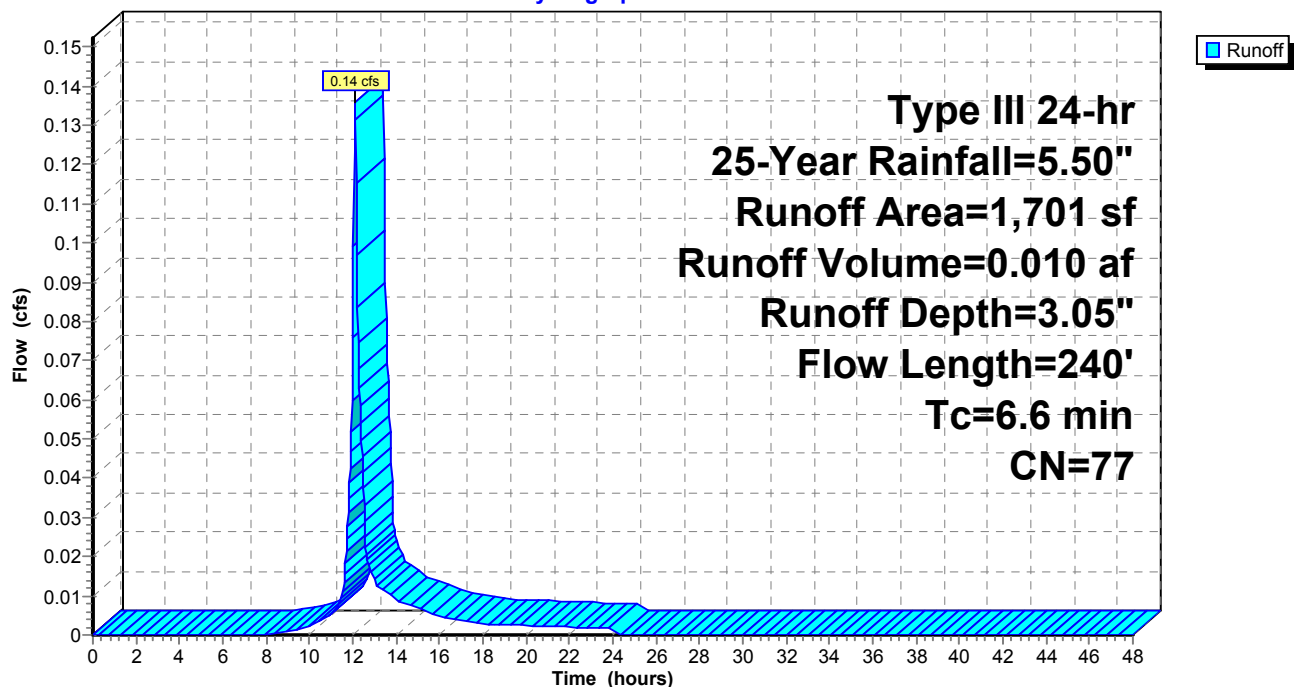
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
615	39	>75% Grass cover, Good, HSG A
* 73	98	Wall, HSG A
* 30	98	Bluestone patio, HSG A
* 970	98	Patio above, HSG A
* 13	98	Stepping stones, HSG A
1,701	77	Weighted Average
615		36.16% Pervious Area
1,086		63.84% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		<b>Sheet Flow, sheet</b>
					Grass: Short n= 0.150 P2= 3.20"
1.0	190	0.0370	3.10		<b>Shallow Concentrated Flow, conc.</b>
					Unpaved Kv= 16.1 fps
6.6	240	Total			

**Subcatchment 1S-7: Upper Patios**

Hydrograph



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Type III 24-hr 25-Year Rainfall=5.50"

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**Summary for Subcatchment 1S-8: 1S-8**

Runoff = 0.00 cfs @ 12.41 hrs, Volume= 0.000 af, Depth= 0.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 25-Year Rainfall=5.50"

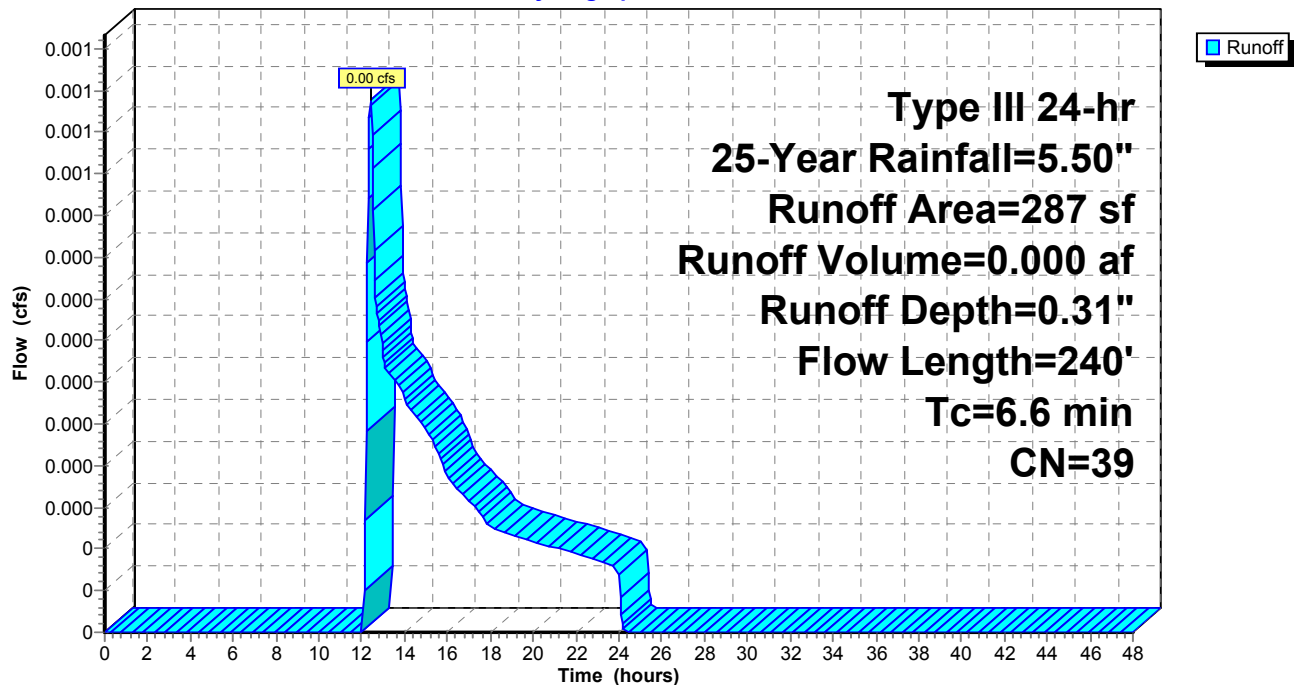
Area (sf)	CN	Description
287	39	>75% Grass cover, Good, HSG A
287		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		<b>Sheet Flow, sheet</b>
					Grass: Short n= 0.150 P2= 3.20"
1.0	190	0.0370	3.10		<b>Shallow Concentrated Flow, conc.</b>
					Unpaved Kv= 16.1 fps
6.6	240	Total			

**Subcatchment 1S-8: 1S-8**

Hydrograph



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Type III 24-hr 25-Year Rainfall=5.50"

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### Summary for Subcatchment R-1: ROOF

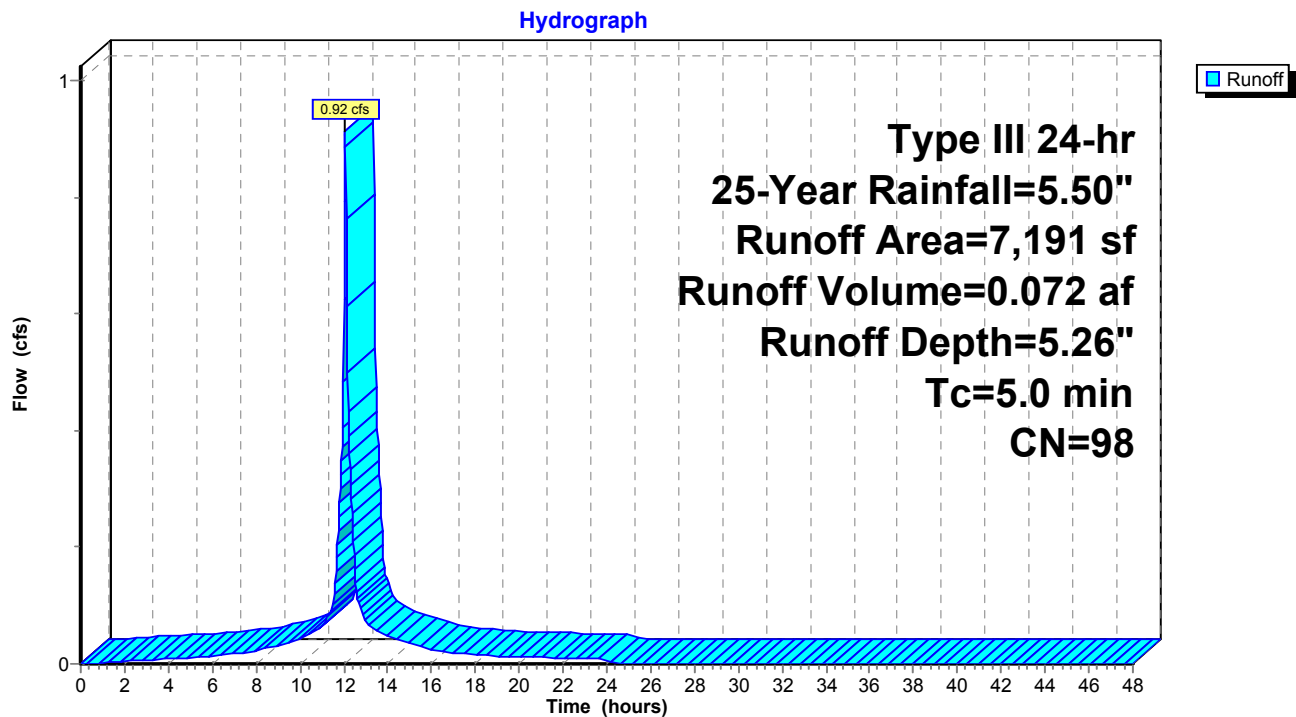
Runoff = 0.92 cfs @ 12.07 hrs, Volume= 0.072 af, Depth= 5.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
7,191	98	Unconnected roofs, HSG A
7,191		100.00% Impervious Area
7,191		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry, direct

### Subcatchment R-1: ROOF



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Type III 24-hr 25-Year Rainfall=5.50"

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### Summary for Subcatchment R-2: ROOF

Runoff = 1.72 cfs @ 12.07 hrs, Volume= 0.136 af, Depth= 5.26"

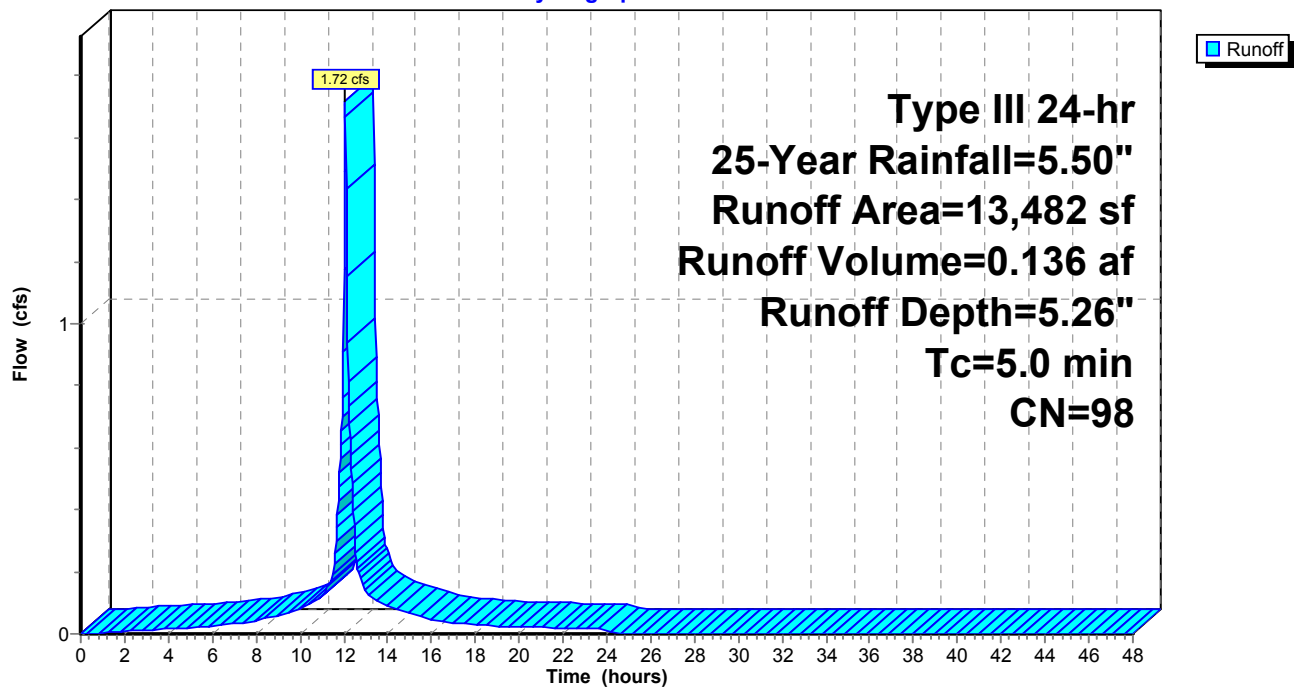
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 25-Year Rainfall=5.50"

Area (sf)	CN	Description
13,482	98	Unconnected roofs, HSG A
13,482		100.00% Impervious Area
13,482		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry, direct

### Subcatchment R-2: ROOF

Hydrograph



## 217-177 Post Development PSI

Type III 24-hr 25-Year Rainfall=5.50"

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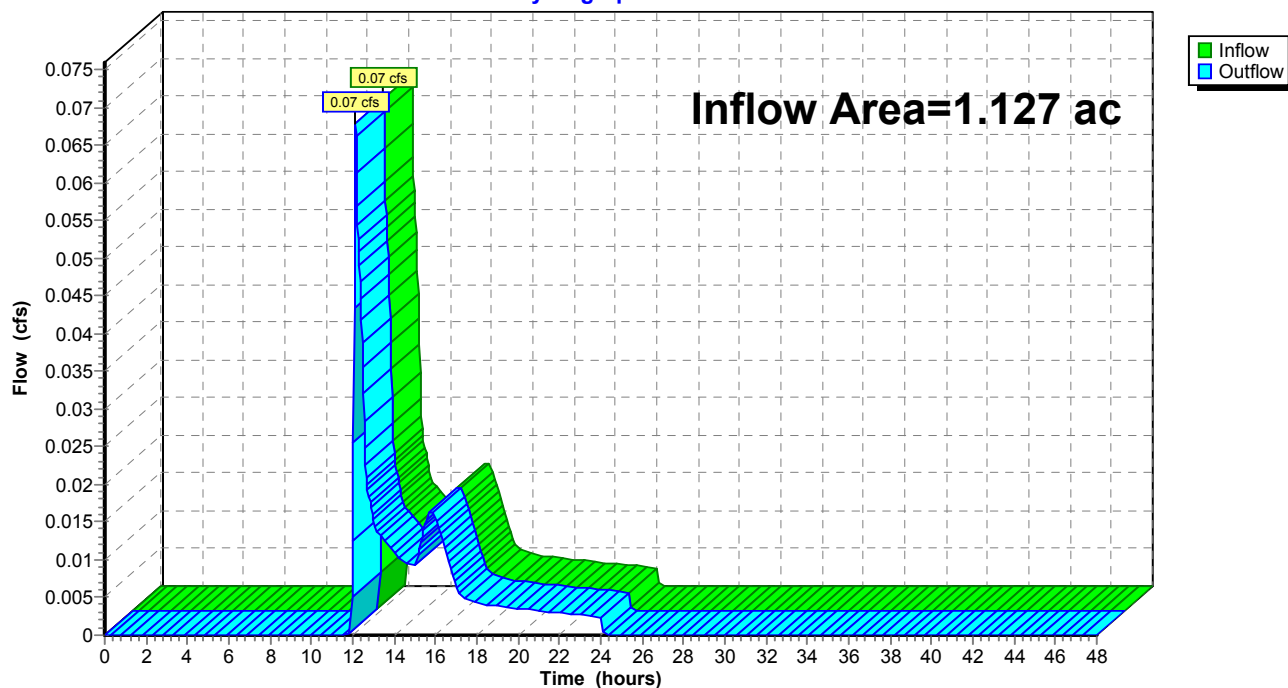
### Summary for Reach DP-1: DP-1

Inflow Area = 1.127 ac, 67.42% Impervious, Inflow Depth = 0.09" for 25-Year event  
Inflow = 0.07 cfs @ 12.13 hrs, Volume= 0.009 af  
Outflow = 0.07 cfs @ 12.13 hrs, Volume= 0.009 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs / 3

### Reach DP-1: DP-1

#### Hydrograph



**217-177 Post Development PSI**

Type III 24-hr 25-Year Rainfall=5.50"

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**Summary for Pond D-1: Area Behind Wall**

Inflow Area = 1.801 ac, 2.48% Impervious, Inflow Depth = 0.23" for 25-Year event  
 Inflow = 0.07 cfs @ 12.64 hrs, Volume= 0.034 af  
 Outflow = 0.07 cfs @ 12.68 hrs, Volume= 0.034 af, Atten= 1%, Lag= 2.5 min  
 Primary = 0.07 cfs @ 12.68 hrs, Volume= 0.034 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs / 3  
 Peak Elev= 148.06' @ 12.68 hrs Surf.Area= 199 sf Storage= 10 cf

Plug-Flow detention time= 3.1 min calculated for 0.034 af (100% of inflow)  
 Center-of-Mass det. time= 3.1 min ( 1,019.4 - 1,016.4 )

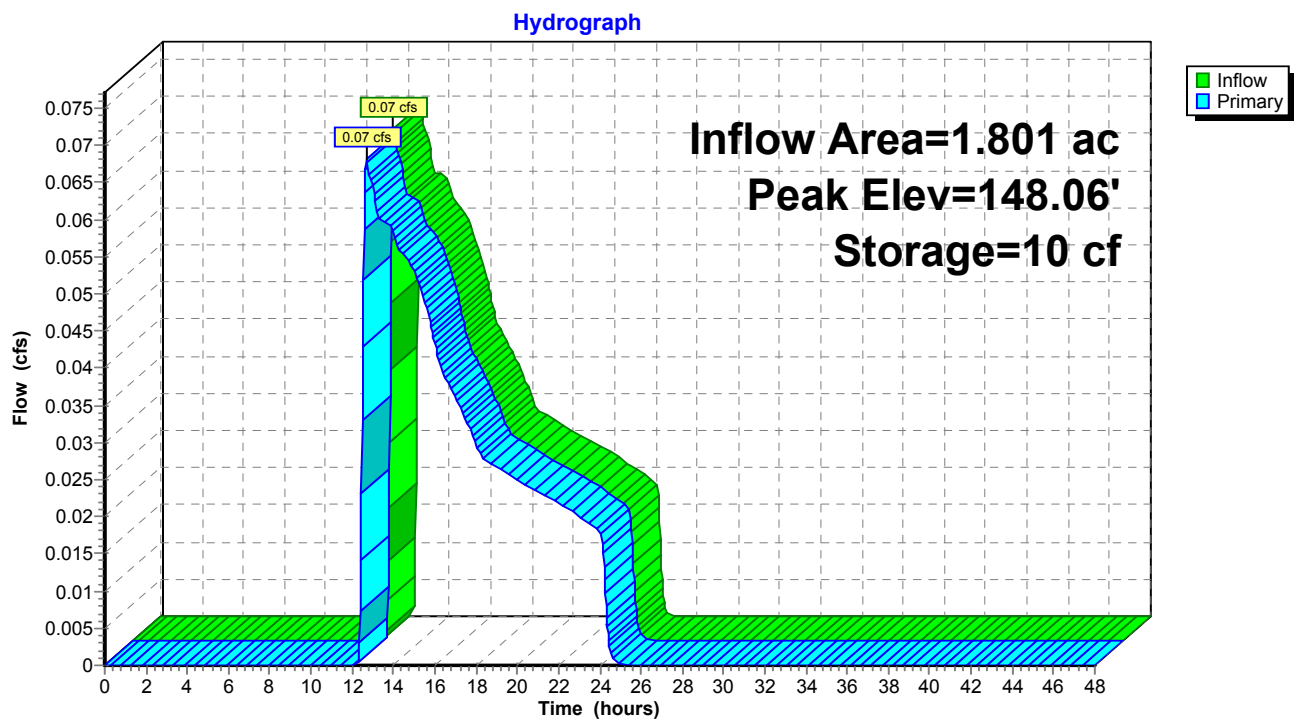
Volume	Invert	Avail.Storage	Storage Description
#1	148.00'	1,496 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
148.00	173	0	0
149.00	637	405	405
150.00	1,545	1,091	1,496

Device	Routing	Invert	Outlet Devices
#1	Primary	148.00'	<b>2.0" Horiz. Orifice/Grate X 3.00</b> C= 0.600 Limited to weir flow at low heads

**Primary OutFlow** Max=0.07 cfs @ 12.68 hrs HW=148.06' TW=138.76' (Dynamic Tailwater)  
 ↑ **1=Orifice/Grate** (Weir Controls 0.07 cfs @ 0.77 fps)

### Pond D-1: Area Behind Wall



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Type III 24-hr 25-Year Rainfall=5.50"

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### Summary for Pond DMH-1: DMH-2

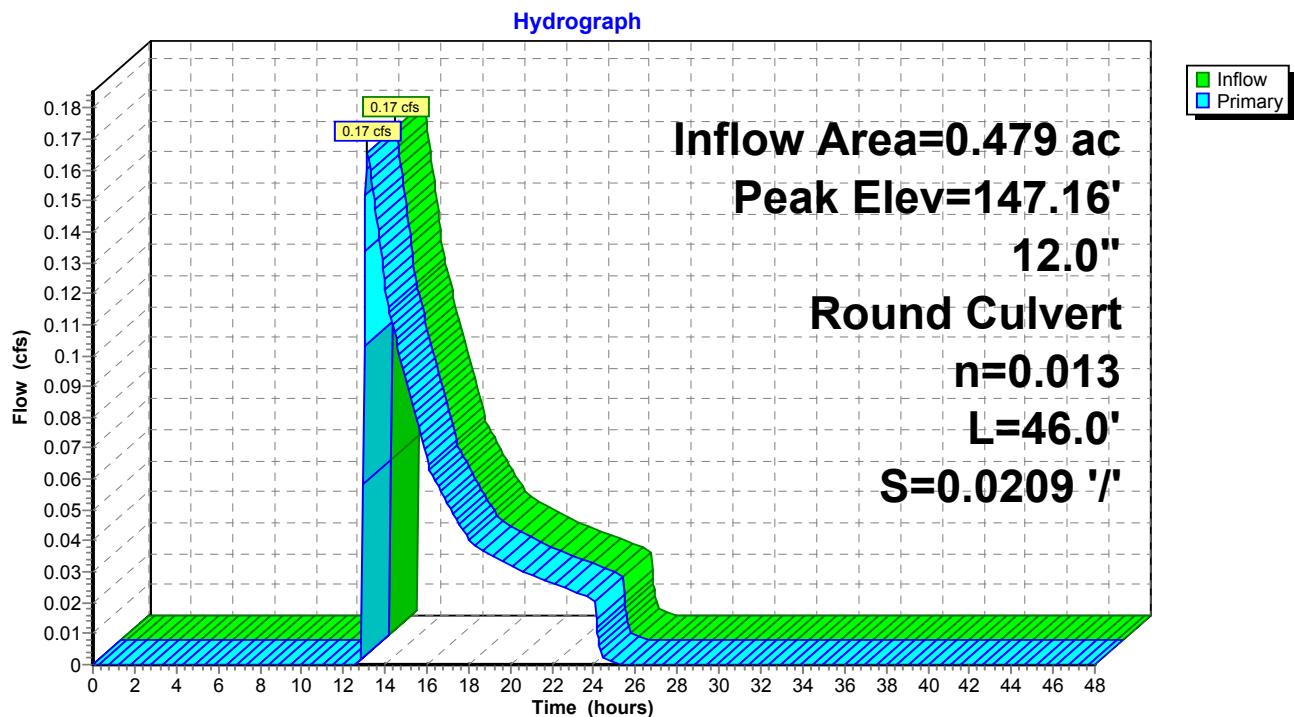
Inflow Area = 0.479 ac, 78.13% Impervious, Inflow Depth = 1.29" for 25-Year event  
Inflow = 0.17 cfs @ 13.15 hrs, Volume= 0.052 af  
Outflow = 0.17 cfs @ 13.15 hrs, Volume= 0.052 af, Atten= 0%, Lag= 0.0 min  
Primary = 0.17 cfs @ 13.15 hrs, Volume= 0.052 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs / 3  
Peak Elev= 147.16' @ 13.15 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	146.96'	<b>12.0" Round Culvert</b> L= 46.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 146.96' / 146.00' S= 0.0209 '/ Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.17 cfs @ 13.15 hrs HW=147.16' TW=146.03' (Dynamic Tailwater)  
↑1=Culvert (Inlet Controls 0.17 cfs @ 1.51 fps)

### Pond DMH-1: DMH-2



**217-177 Post Development PSI**

Type III 24-hr 25-Year Rainfall=5.50"

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**Summary for Pond P-1: ACF R-Tank SD Infiltration System**

Inflow Area = 1.939 ac, 8.11% Impervious, Inflow Depth = 0.54" for 25-Year event  
 Inflow = 0.72 cfs @ 12.07 hrs, Volume= 0.087 af  
 Outflow = 0.21 cfs @ 11.88 hrs, Volume= 0.087 af, Atten= 71%, Lag= 0.0 min  
 Discarded = 0.21 cfs @ 11.88 hrs, Volume= 0.087 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs / 3  
 Peak Elev= 138.80' @ 12.41 hrs Surf.Area= 1,087 sf Storage= 380 cf

Plug-Flow detention time= 6.8 min calculated for 0.087 af (100% of inflow)  
 Center-of-Mass det. time= 6.8 min ( 880.7 - 873.8 )

Volume	Invert	Avail.Storage	Storage Description
#1A	138.20'	664 cf	<b>22.37'W x 48.57'L x 2.12'H Field A</b> 2,304 cf Overall - 645 cf Embedded = 1,660 cf x 40.0% Voids
#2A	138.53'	613 cf	<b>ACF R-Tank SD 1 x 266 Inside #1</b> Inside= 15.7"W x 9.4"H => 0.98 sf x 2.35'L = 2.3 cf Outside= 15.7"W x 9.4"H => 1.03 sf x 2.35'L = 2.4 cf 14 Rows of 19 Chambers
		1,276 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	138.20'	<b>8.270 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'

**Discarded OutFlow** Max=0.21 cfs @ 11.88 hrs HW=138.23' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.21 cfs)

## 217-177 Post Development PSI

Type III 24-hr 25-Year Rainfall=5.50"

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### Pond P-1: ACF R-Tank SD Infiltration System - Chamber Wizard Field A

#### Chamber Model = ACF R-Tank SD 1 (ACF Environmental R-Tank SD)

Inside= 15.7"W x 9.4"H => 0.98 sf x 2.35'L = 2.3 cf

Outside= 15.7"W x 9.4"H => 1.03 sf x 2.35'L = 2.4 cf

19 Chambers/Row x 2.35' Long = 44.57' Row Length +24.0" End Stone x 2 = 48.57' Base Length

14 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 22.37' Base Width

4.0" Base + 9.4" Chamber Height + 12.0" Cover = 2.12' Field Height

266 Chambers x 2.3 cf = 612.5 cf Chamber Storage

266 Chambers x 2.4 cf = 644.8 cf Displacement

2,304.5 cf Field - 644.8 cf Chambers = 1,659.7 cf Stone x 40.0% Voids = 663.9 cf Stone Storage

Chamber Storage + Stone Storage = 1,276.4 cf = 0.029 af

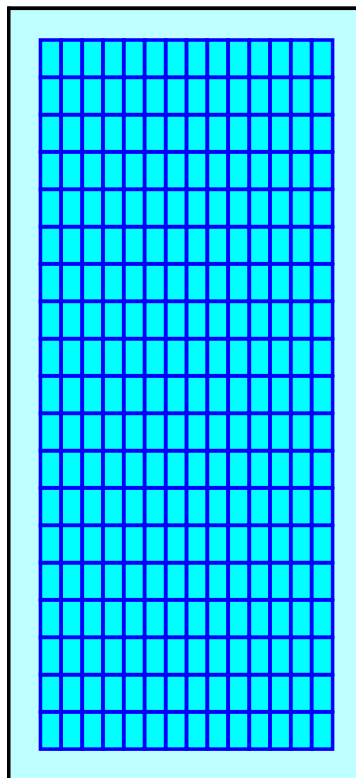
Overall Storage Efficiency = 55.4%

Overall System Size = 48.57' x 22.37' x 2.12'

266 Chambers

85.4 cy Field

61.5 cy Stone



## 217-177 Post Development PSI

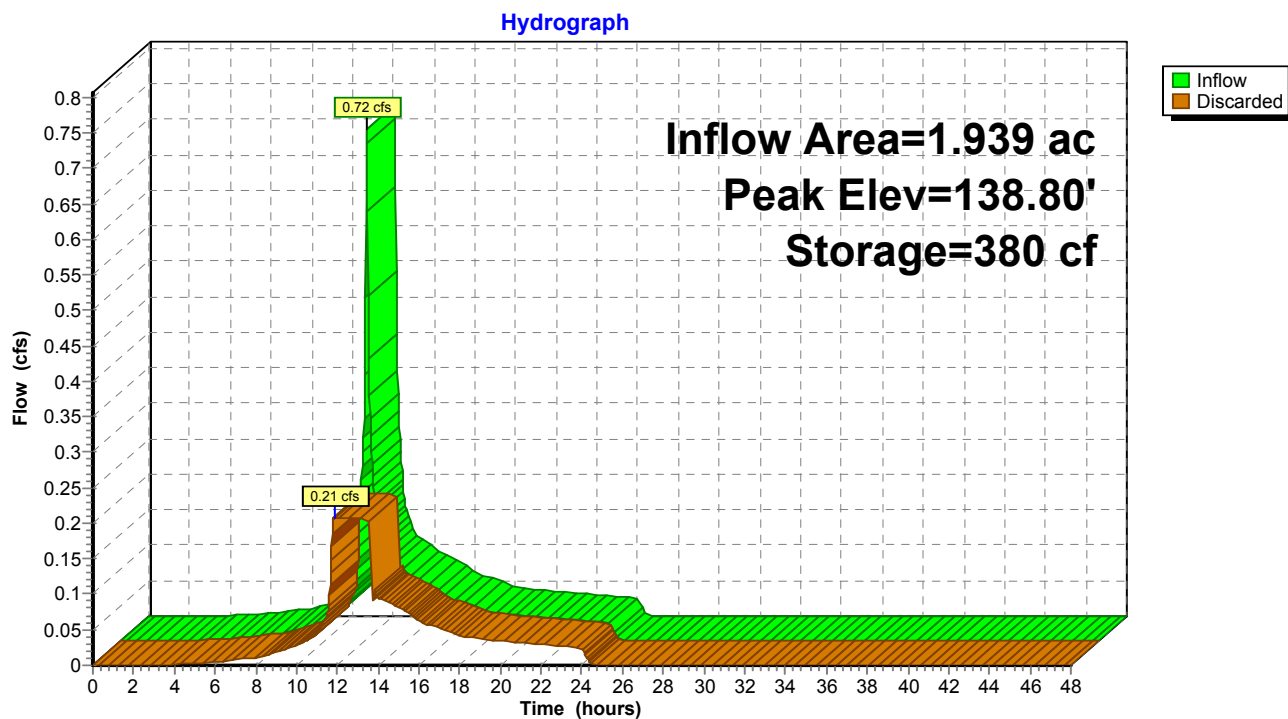
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Type III 24-hr 25-Year Rainfall=5.50"

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### Pond P-1: ACF R-Tank SD Infiltration System



**217-177 Post Development PSI**

Type III 24-hr 25-Year Rainfall=5.50"

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**Summary for Pond P-2: Cultec Infiltration System**

Inflow Area = 0.479 ac, 78.13% Impervious, Inflow Depth = 3.87" for 25-Year event  
 Inflow = 2.10 cfs @ 12.07 hrs, Volume= 0.155 af  
 Outflow = 0.27 cfs @ 11.70 hrs, Volume= 0.091 af, Atten= 87%, Lag= 0.0 min  
 Discarded = 0.27 cfs @ 11.70 hrs, Volume= 0.040 af  
 Primary = 0.17 cfs @ 13.15 hrs, Volume= 0.052 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs / 3

Peak Elev= 149.40' @ 13.15 hrs Surf.Area= 1,531 sf Storage= 2,808 cf

Plug-Flow detention time= 154.4 min calculated for 0.091 af (59% of inflow)

Center-of-Mass det. time= 42.9 min ( 829.1 - 786.2 )

Volume	Invert	Avail.Storage	Storage Description
#1A	146.80'	1,317 cf	<b>20.83'W x 73.50'L x 3.54'H Field A</b> 5,423 cf Overall - 2,131 cf Embedded = 3,292 cf x 40.0% Voids
#2A	147.30'	2,131 cf	<b>Cultec R-330XLHD x 40 Inside #1</b> Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 4 rows
		3,448 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	147.13'	<b>12.0" Round 147.13</b> L= 17.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 147.13' / 146.96' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	149.35'	<b>4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)</b>
#3	Discarded	146.80'	<b>Special &amp; User-Defined</b> Head (feet) 0.00 0.10 0.50 1.00 1.50 1.51 1.52 2.00 3.54 Disch. (cfs) 0.000 0.270 0.270 0.270 0.270 0.270 0.270 0.000 0.000 0.000

**Discarded OutFlow** Max=0.27 cfs @ 11.70 hrs HW=146.92' (Free Discharge)↑**3=Special & User-Defined** (Custom Controls 0.27 cfs)**Primary OutFlow** Max=0.17 cfs @ 13.15 hrs HW=149.40' TW=147.16' (Dynamic Tailwater)↑**1=147.13** (Passes 0.17 cfs of 3.98 cfs potential flow)↑**2=Sharp-Crested Rectangular Weir**(Weir Controls 0.17 cfs @ 0.76 fps)

## 217-177 Post Development PSI

Type III 24-hr 25-Year Rainfall=5.50"

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### Pond P-2: Cultec Infiltration System - Chamber Wizard Field A

#### Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 4 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

10 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 71.50' Row Length +12.0" End Stone x 2 = 73.50' Base Length

4 Rows x 52.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 20.83' Base Width

6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

40 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 4 Rows = 2,131.0 cf Chamber Storage

5,423.2 cf Field - 2,131.0 cf Chambers = 3,292.2 cf Stone x 40.0% Voids = 1,316.9 cf Stone Storage

Chamber Storage + Stone Storage = 3,447.9 cf = 0.079 af

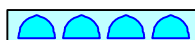
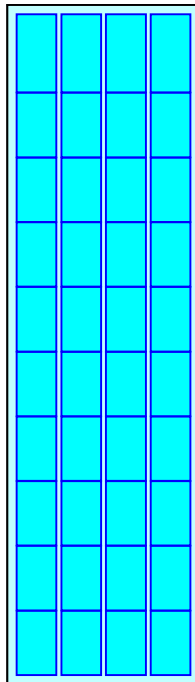
Overall Storage Efficiency = 63.6%

Overall System Size = 73.50' x 20.83' x 3.54'

40 Chambers

200.9 cy Field

121.9 cy Stone



## 217-177 Post Development PSI

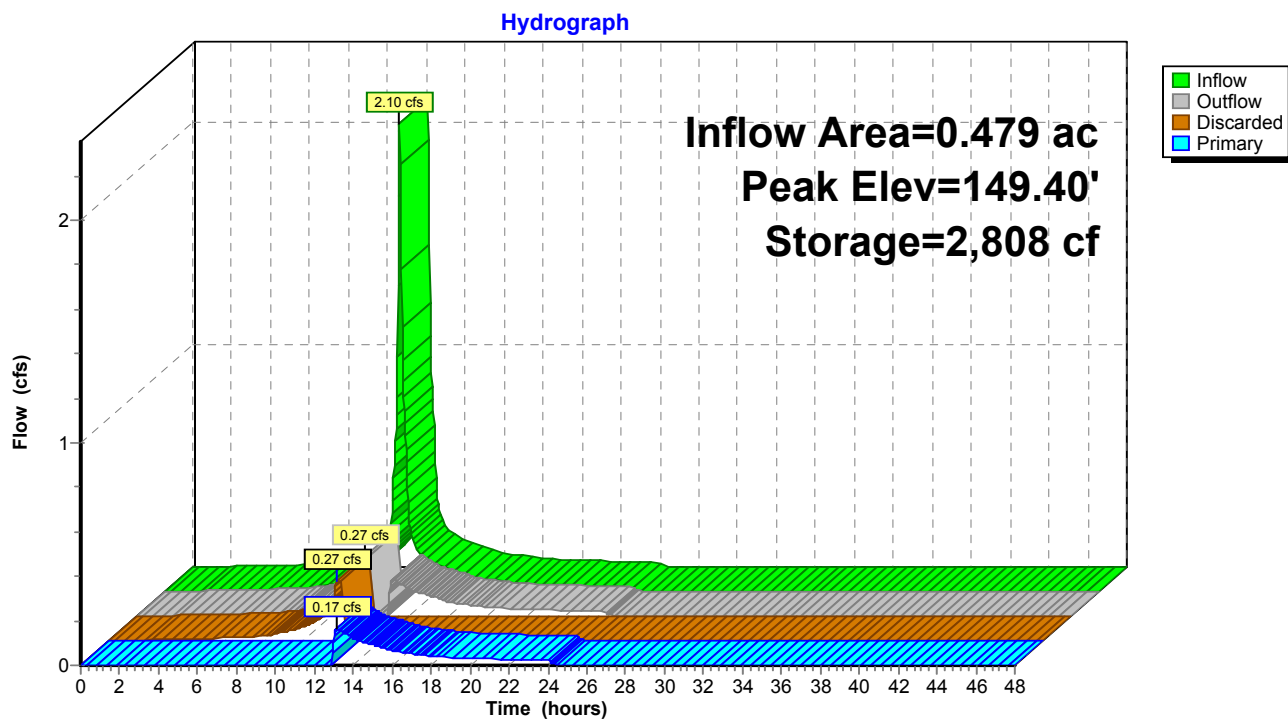
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Type III 24-hr 25-Year Rainfall=5.50"

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### Pond P-2: Cultec Infiltration System



**217-177 Post Development PSI**

Type III 24-hr 25-Year Rainfall=5.50"

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**Summary for Pond P-3: Cultec Infiltration System**

Inflow Area = 1.003 ac, 73.94% Impervious, Inflow Depth = 2.91" for 25-Year event  
 Inflow = 2.45 cfs @ 12.08 hrs, Volume= 0.243 af  
 Outflow = 0.15 cfs @ 15.86 hrs, Volume= 0.243 af, Atten= 94%, Lag= 226.7 min  
 Discarded = 0.14 cfs @ 11.22 hrs, Volume= 0.242 af  
 Primary = 0.01 cfs @ 15.86 hrs, Volume= 0.001 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs / 3

Peak Elev= 146.57' @ 15.86 hrs Surf.Area= 2,477 sf Storage= 4,538 cf

Plug-Flow detention time= 303.1 min calculated for 0.243 af (100% of inflow)

Center-of-Mass det. time= 303.1 min ( 1,119.9 - 816.8 )

Volume	Invert	Avail.Storage	Storage Description
#1A	144.00'	2,095 cf	<b>64.33'W x 38.50'L x 3.54'H Field A</b> 8,772 cf Overall - 3,535 cf Embedded = 5,237 cf x 40.0% Voids
#2A	144.50'	3,535 cf	<b>Cultec R-330XLHD x 65 Inside #1</b> Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 13 rows
		5,630 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	146.50'	<b>4.0" Round Culvert</b> L= 14.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 146.50' / 146.36' S= 0.0100 ' / Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.09 sf
#2	Discarded	144.00'	<b>2.410 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'

**Discarded OutFlow** Max=0.14 cfs @ 11.22 hrs HW=144.04' (Free Discharge)↑ **2=Exfiltration** (Exfiltration Controls 0.14 cfs)**Primary OutFlow** Max=0.01 cfs @ 15.86 hrs HW=146.57' TW=0.00' (Dynamic Tailwater)↑ **1=Culvert** (Barrel Controls 0.01 cfs @ 1.11 fps)

## 217-177 Post Development PSI

Type III 24-hr 25-Year Rainfall=5.50"

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### Pond P-3: Cultec Infiltration System - Chamber Wizard Field A

#### Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 13 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

5 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 36.50' Row Length +12.0" End Stone x 2 = 38.50' Base Length

13 Rows x 52.0" Wide + 6.0" Spacing x 12 + 12.0" Side Stone x 2 = 64.33' Base Width

6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

65 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 13 Rows = 3,535.5 cf Chamber Storage

8,772.1 cf Field - 3,535.5 cf Chambers = 5,236.6 cf Stone x 40.0% Voids = 2,094.6 cf Stone Storage

Chamber Storage + Stone Storage = 5,630.1 cf = 0.129 af

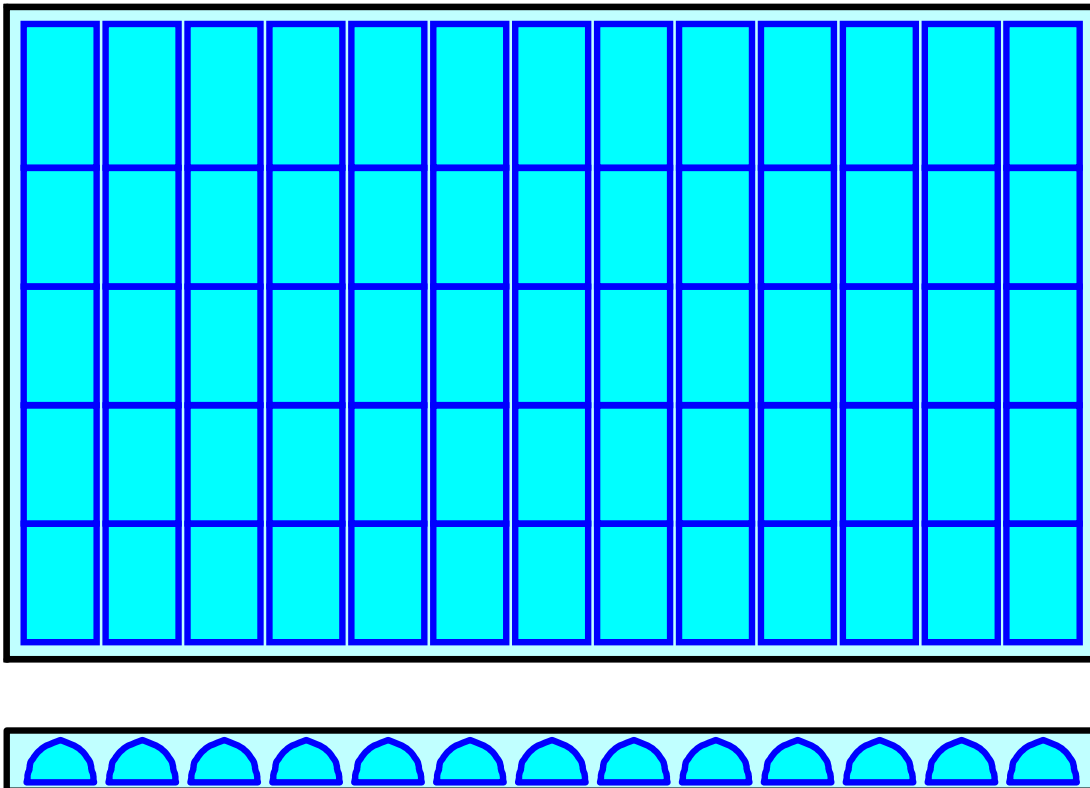
Overall Storage Efficiency = 64.2%

Overall System Size = 38.50' x 64.33' x 3.54'

65 Chambers

324.9 cy Field

193.9 cy Stone



## 217-177 Post Development PSI

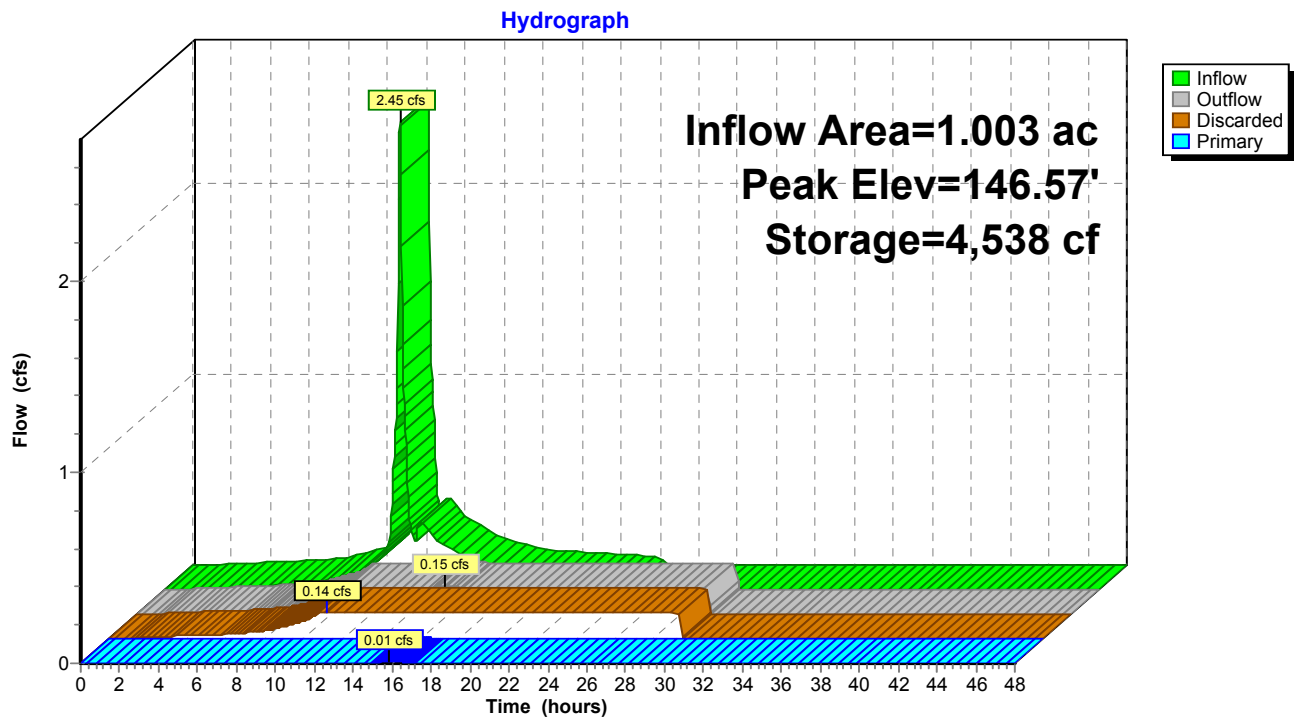
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Type III 24-hr 25-Year Rainfall=5.50"

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### Pond P-3: Cultec Infiltration System



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Type III 24-hr 25-Year Rainfall=5.50"

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**Summary for Pond P-4: ACF R-Tank SD Infiltration System**

Inflow Area = 0.052 ac, 78.10% Impervious, Inflow Depth = 3.88" for 25-Year event  
 Inflow = 0.22 cfs @ 12.09 hrs, Volume= 0.017 af  
 Outflow = 0.02 cfs @ 11.64 hrs, Volume= 0.017 af, Atten= 91%, Lag= 0.0 min  
 Discarded = 0.02 cfs @ 11.64 hrs, Volume= 0.017 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs / 3  
 Peak Elev= 139.23' @ 13.02 hrs Surf.Area= 364 sf Storage= 265 cf

Plug-Flow detention time= 99.4 min calculated for 0.017 af (100% of inflow)  
 Center-of-Mass det. time= 99.3 min ( 886.8 - 787.5 )

Volume	Invert	Avail.Storage	Storage Description
#1A	138.00'	234 cf	<b>10.56'W x 34.50'L x 2.04'H Field A</b> 742 cf Overall - 158 cf Embedded = 585 cf x 40.0% Voids
#2A	138.25'	150 cf	<b>ACF R-Tank SD 1 x 65 Inside #1</b> Inside= 15.7"W x 9.4"H => 0.98 sf x 2.35'L = 2.3 cf Outside= 15.7"W x 9.4"H => 1.03 sf x 2.35'L = 2.4 cf 5 Rows of 13 Chambers
		384 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	138.00'	<b>2.410 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'

**Discarded OutFlow** Max=0.02 cfs @ 11.64 hrs HW=138.02' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

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Type III 24-hr 25-Year Rainfall=5.50"

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### Pond P-4: ACF R-Tank SD Infiltration System - Chamber Wizard Field A

#### Chamber Model = ACF R-Tank SD 1 (ACF Environmental R-Tank SD)

Inside= 15.7"W x 9.4"H => 0.98 sf x 2.35'L = 2.3 cf

Outside= 15.7"W x 9.4"H => 1.03 sf x 2.35'L = 2.4 cf

13 Chambers/Row x 2.35' Long = 30.50' Row Length +24.0" End Stone x 2 = 34.50' Base Length

5 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 10.56' Base Width

3.0" Base + 9.4" Chamber Height + 12.0" Cover = 2.04' Field Height

65 Chambers x 2.3 cf = 149.7 cf Chamber Storage

65 Chambers x 2.4 cf = 157.6 cf Displacement

742.3 cf Field - 157.6 cf Chambers = 584.7 cf Stone x 40.0% Voids = 233.9 cf Stone Storage

Chamber Storage + Stone Storage = 383.6 cf = 0.009 af

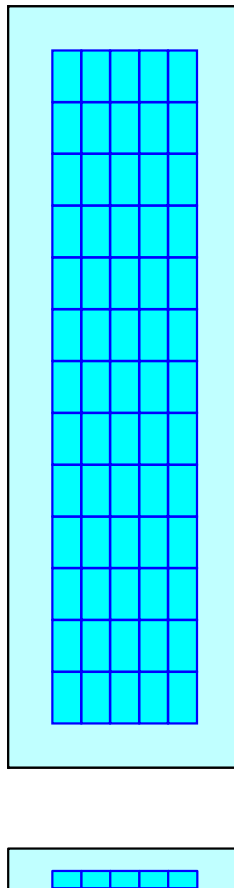
Overall Storage Efficiency = 51.7%

Overall System Size = 34.50' x 10.56' x 2.04'

65 Chambers

27.5 cy Field

21.7 cy Stone



## 217-177 Post Development PSI

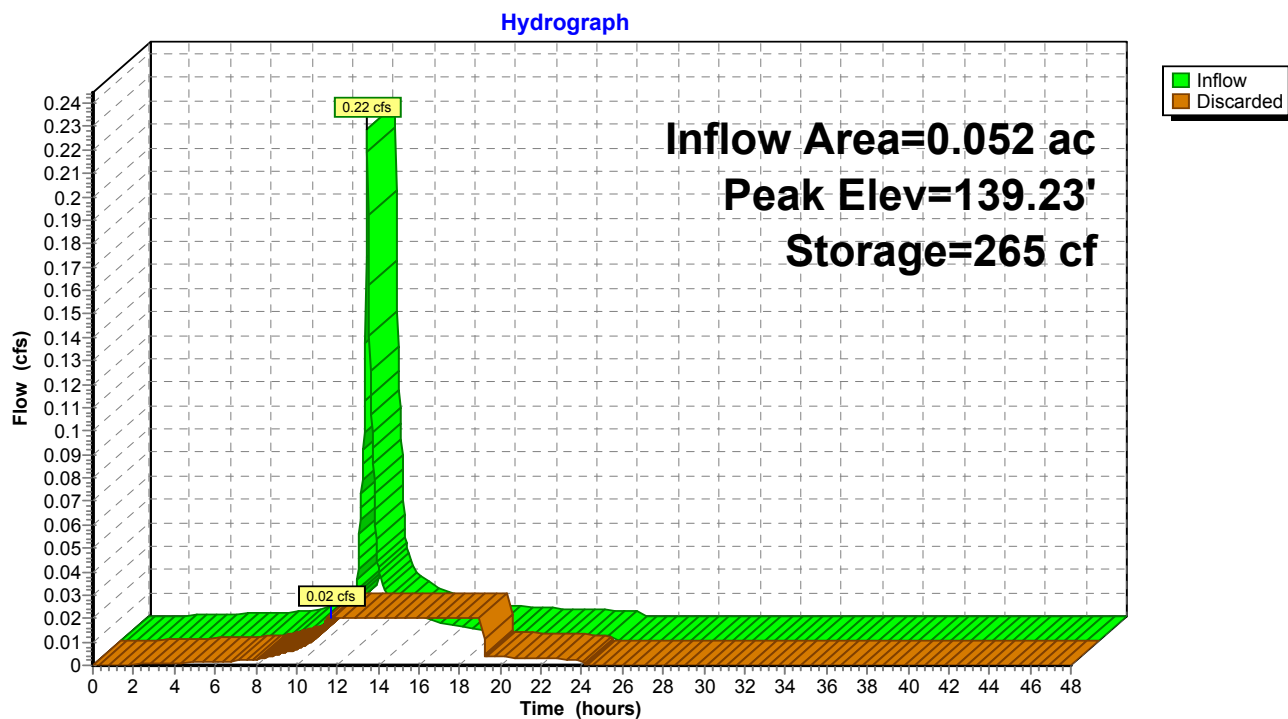
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Type III 24-hr 25-Year Rainfall=5.50"

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### Pond P-4: ACF R-Tank SD Infiltration System



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Type III 24-hr 25-Year Rainfall=5.50"

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**Summary for Pond P-5: Cultec Infiltration System**

Inflow Area = 0.039 ac, 63.84% Impervious, Inflow Depth = 3.05" for 25-Year event  
 Inflow = 0.14 cfs @ 12.10 hrs, Volume= 0.010 af  
 Outflow = 0.01 cfs @ 11.70 hrs, Volume= 0.010 af, Atten= 94%, Lag= 0.0 min  
 Discarded = 0.01 cfs @ 11.70 hrs, Volume= 0.010 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs / 3  
 Peak Elev= 148.80' @ 14.10 hrs Surf.Area= 155 sf Storage= 195 cf

Plug-Flow detention time= 215.7 min calculated for 0.010 af (100% of inflow)  
 Center-of-Mass det. time= 215.6 min ( 1,041.6 - 826.0 )

Volume	Invert	Avail.Storage	Storage Description
#1A	147.50'	363 cf	<b>6.33'W x 24.50'L x 3.54'H Field A</b> 550 cf Overall - 168 cf Embedded = 382 cf x 95.0% Voids
#2A	148.00'	168 cf	<b>Cultec R-330XLHD x 3 Inside #1</b> Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 1 rows
		530 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	147.50'	<b>2.410 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'

**Discarded OutFlow** Max=0.01 cfs @ 11.70 hrs HW=147.54' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

## 217-177 Post Development PSI

Type III 24-hr 25-Year Rainfall=5.50"

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### Pond P-5: Cultec Infiltration System - Chamber Wizard Field A

#### Chamber Model = Cultec R-330XLHD (Cultec Recharger®330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 1 rows

3 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 22.50' Row Length +12.0" End Stone x 2 = 24.50' Base Length

1 Rows x 52.0" Wide + 12.0" Side Stone x 2 = 6.33' Base Width

6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

3 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 1 Rows = 167.6 cf Chamber Storage

549.5 cf Field - 167.6 cf Chambers = 381.9 cf Stone x 95.0% Voids = 362.8 cf Stone Storage

Chamber Storage + Stone Storage = 530.5 cf = 0.012 af

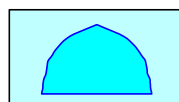
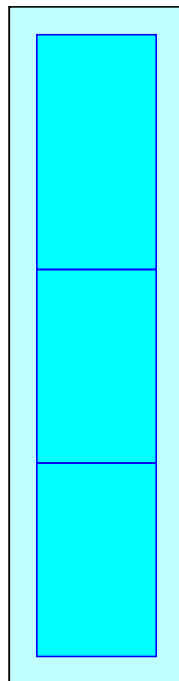
Overall Storage Efficiency = 96.5%

Overall System Size = 24.50' x 6.33' x 3.54'

3 Chambers

20.4 cy Field

14.1 cy Stone



## 217-177 Post Development PSI

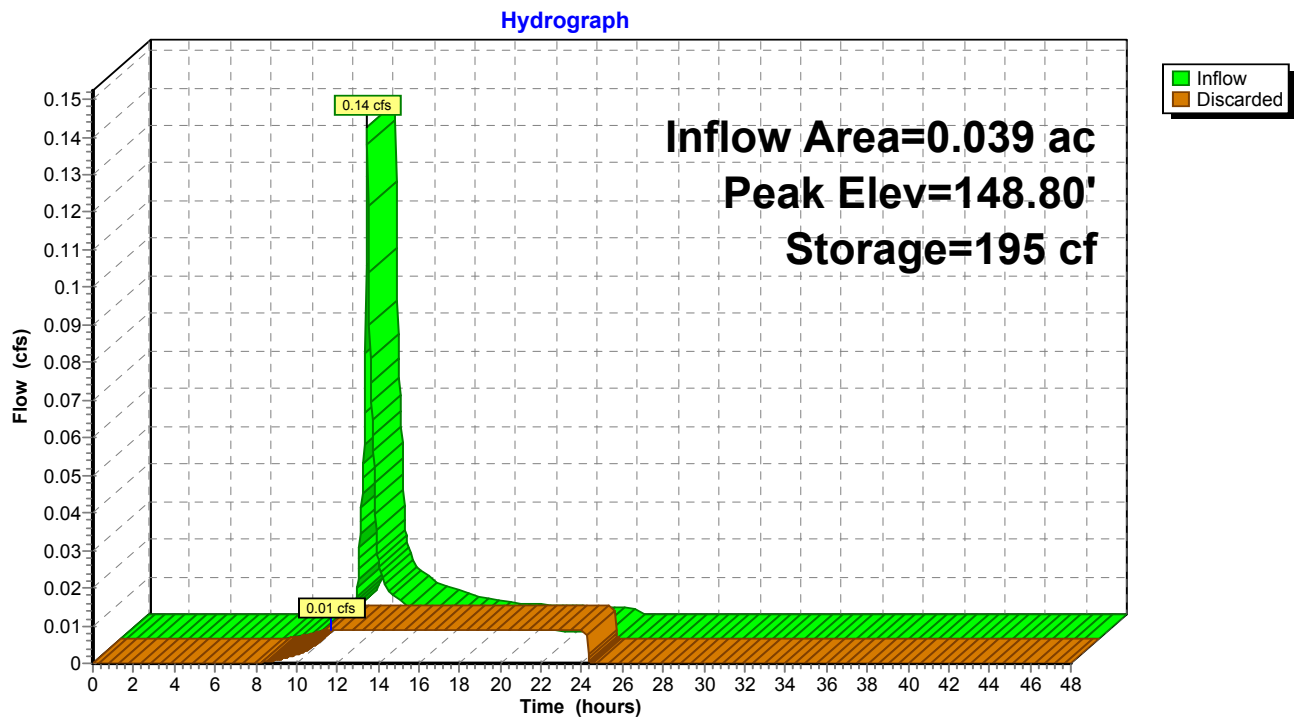
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Type III 24-hr 25-Year Rainfall=5.50"

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### Pond P-5: Cultec Infiltration System



**217-177 Post Development PSI***Type III 24-hr 100-Year Rainfall=6.70"*

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Time span=0.00-48.00 hrs, dt=0.03 hrs, 1601 points x 3  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment1S: OFFSITE NORTHWEST** Runoff Area=78,453 sf 2.48% Impervious Runoff Depth=0.53"  
 Flow Length=434' Tc=16.4 min CN=37 Runoff=0.36 cfs 0.080 af

**Subcatchment1S-1: 1S-1** Runoff Area=6,026 sf 81.48% Impervious Runoff Depth=5.76"  
 Tc=5.0 min CN=92 Runoff=0.89 cfs 0.066 af

**Subcatchment1S-2: 1S-2** Runoff Area=13,675 sf 66.63% Impervious Runoff Depth=4.20"  
 Tc=5.0 min CN=78 Runoff=1.59 cfs 0.110 af

**Subcatchment1S-3: 1S-3** Runoff Area=9,337 sf 26.97% Impervious Runoff Depth=4.20"  
 Flow Length=240' Tc=6.6 min CN=78 Runoff=1.03 cfs 0.075 af

**Subcatchment1S-4: 1S-4** Runoff Area=5,139 sf 15.78% Impervious Runoff Depth=1.34"  
 Flow Length=240' Tc=6.6 min CN=48 Runoff=0.15 cfs 0.013 af

**Subcatchment1S-5: Lower Patio** Runoff Area=791 sf 100.00% Impervious Runoff Depth=6.46"  
 Flow Length=240' Tc=6.6 min CN=98 Runoff=0.12 cfs 0.010 af

**Subcatchment1S-6: Lower Patio** Runoff Area=1,492 sf 66.49% Impervious Runoff Depth=4.20"  
 Flow Length=240' Tc=6.6 min CN=78 Runoff=0.16 cfs 0.012 af

**Subcatchment1S-7: Upper Patios** Runoff Area=1,701 sf 63.84% Impervious Runoff Depth=4.10"  
 Flow Length=240' Tc=6.6 min CN=77 Runoff=0.18 cfs 0.013 af

**Subcatchment1S-8: 1S-8** Runoff Area=287 sf 0.00% Impervious Runoff Depth=0.66"  
 Flow Length=240' Tc=6.6 min CN=39 Runoff=0.00 cfs 0.000 af

**SubcatchmentR-1: ROOF** Runoff Area=7,191 sf 100.00% Impervious Runoff Depth=6.46"  
 Tc=5.0 min CN=98 Runoff=1.12 cfs 0.089 af

**SubcatchmentR-2: ROOF** Runoff Area=13,482 sf 100.00% Impervious Runoff Depth=6.46"  
 Tc=5.0 min CN=98 Runoff=2.09 cfs 0.167 af

**Reach DP-1: DP-1** Inflow=0.31 cfs 0.081 af  
 Outflow=0.31 cfs 0.081 af

**Pond D-1: Area Behind Wall** Peak Elev=148.62' Storage=195 cf Inflow=0.36 cfs 0.080 af  
 Outflow=0.25 cfs 0.080 af

**Pond DMH-1: DMH-2** Peak Elev=147.40' Inflow=0.76 cfs 0.088 af  
 12.0" Round Culvert n=0.013 L=46.0' S=0.0209 '/' Outflow=0.76 cfs 0.088 af

**Pond P-1: ACF R-Tank SD Infiltration System** Peak Elev=139.95' Storage=1,113 cf Inflow=0.89 cfs 0.147 af  
 Outflow=0.21 cfs 0.147 af

**Pond P-2: Cultec Infiltration System** Peak Elev=149.50' Storage=2,895 cf Inflow=2.70 cfs 0.199 af  
 Discarded=0.27 cfs 0.047 af Primary=0.76 cfs 0.088 af Outflow=0.76 cfs 0.136 af

## 217-177 Post Development PSI

Type III 24-hr 100-Year Rainfall=6.70"

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**Pond P-3: Cultec Infiltration System** Peak Elev=147.28' Storage=5,369 cf Inflow=3.08 cfs 0.330 af  
Discarded=0.14 cfs 0.262 af Primary=0.29 cfs 0.067 af Outflow=0.43 cfs 0.330 af

**Pond P-4: ACF R-Tank SD Infiltration System** Peak Elev=140.00' Storage=379 cf Inflow=0.28 cfs 0.022 af  
Outflow=0.02 cfs 0.022 af

**Pond P-5: Cultec Infiltration System** Peak Elev=149.46' Storage=295 cf Inflow=0.18 cfs 0.013 af  
Outflow=0.01 cfs 0.013 af

**Total Runoff Area = 3.158 ac Runoff Volume = 0.636 af Average Runoff Depth = 2.42"**  
**68.86% Pervious = 2.175 ac 31.14% Impervious = 0.983 ac**

**217-177 Post Development PSI**

Type III 24-hr 100-Year Rainfall=6.70"

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**Summary for Subcatchment 1S: OFFSITE NORTHWEST**

Runoff = 0.36 cfs @ 12.49 hrs, Volume= 0.080 af, Depth= 0.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 100-Year Rainfall=6.70"

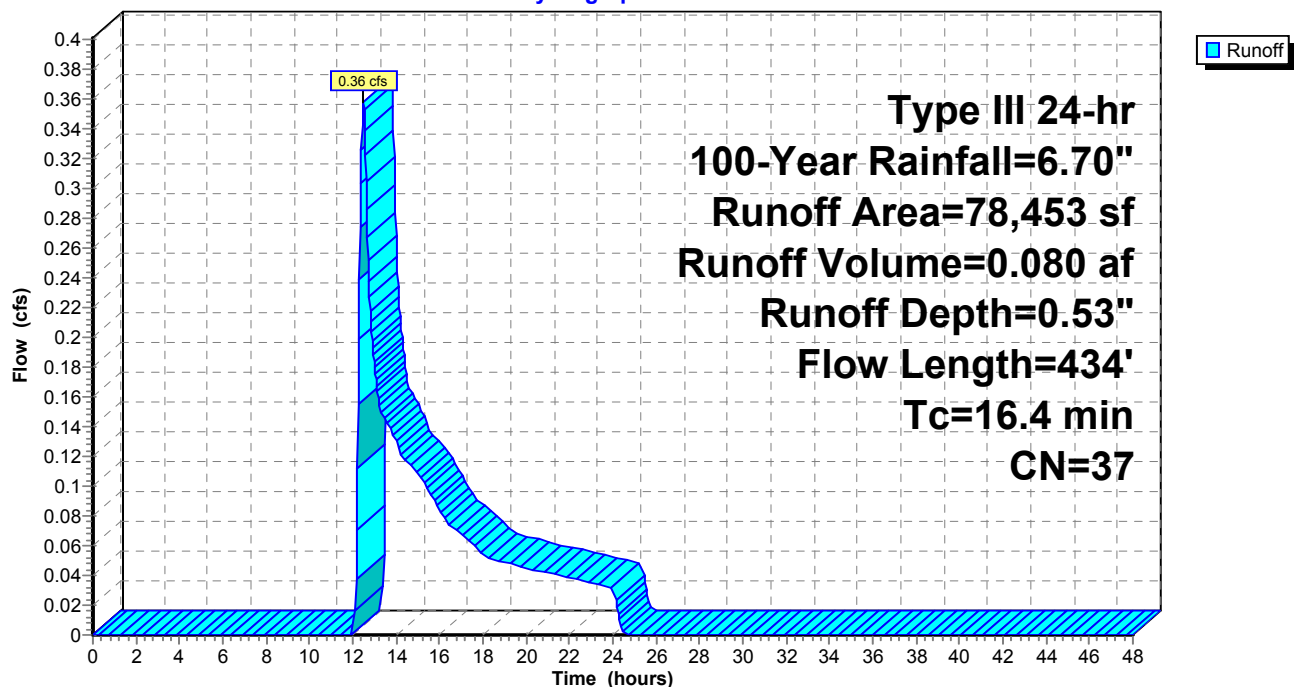
	Area (sf)	CN	Description
*	61,141	30	Woods, Good, HSG A (offsite)
*	5,064	96	Gravel surface, HSG A (offsite)
*	8,863	39	>75% Grass cover, Good, HSG A (offsite)
*	1,942	98	Roofs, HSG A (offsite)
	1,443	39	>75% Grass cover, Good, HSG A
	78,453	37	Weighted Average
	76,511		97.52% Pervious Area
	1,942		2.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	50	0.0150	0.06		<b>Sheet Flow, SHEET FLOW</b>
					Woods: Light underbrush n= 0.400 P2= 3.20"
2.6	384	0.0236	2.47		<b>Shallow Concentrated Flow, SHALLOW CONC. FLOW</b>
					Unpaved Kv= 16.1 fps
16.4	434	Total			

**Subcatchment 1S: OFFSITE NORTHWEST**

Hydrograph



**217-177 Post Development PSI**

Type III 24-hr 100-Year Rainfall=6.70"

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**Summary for Subcatchment 1S-1: 1S-1**

Runoff = 0.89 cfs @ 12.07 hrs, Volume= 0.066 af, Depth= 5.76"

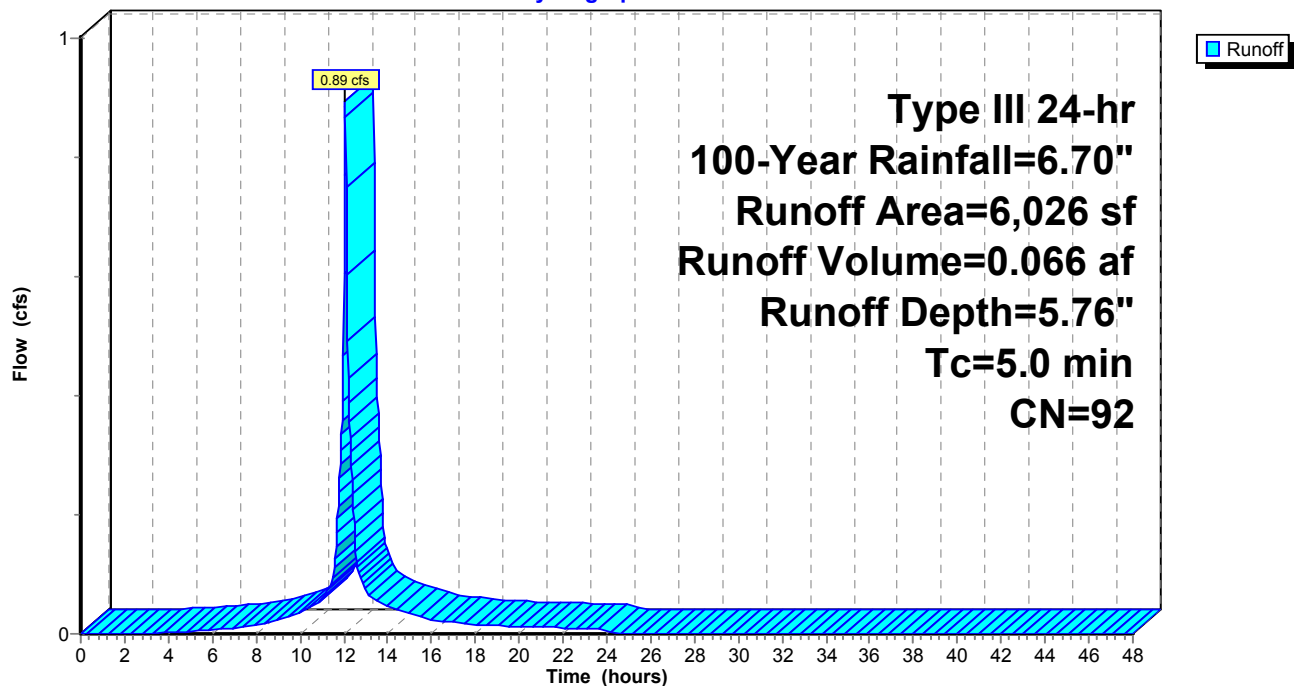
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 100-Year Rainfall=6.70"

	Area (sf)	CN	Description
*	1,116	64	Permeable pavers, HSG A
	3,665	98	Paved parking, HSG A
*	401	98	Patio above, HSG A
*	552	98	Wall, HSG A
*	292	98	Walk, HSG A
	6,026	92	Weighted Average
	1,116		18.52% Pervious Area
	4,910		81.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry, direct

**Subcatchment 1S-1: 1S-1**

Hydrograph



**217-177 Post Development PSI**

Type III 24-hr 100-Year Rainfall=6.70"

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**Summary for Subcatchment 1S-2: 1S-2**

Runoff = 1.59 cfs @ 12.07 hrs, Volume= 0.110 af, Depth= 4.20"

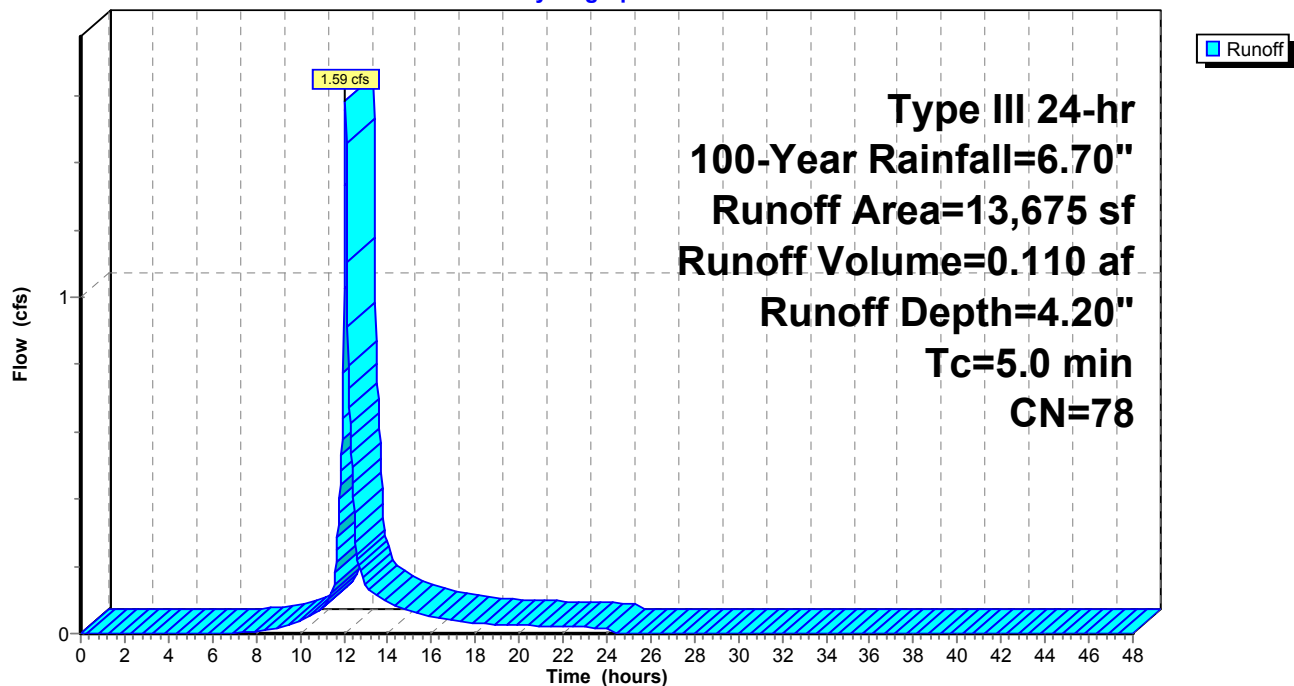
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
4,564	39	>75% Grass cover, Good, HSG A
8,635	98	Paved parking, HSG A
* 226	98	Wall, HSG A
* 250	98	Bluestone patio, HSG A
13,675	78	Weighted Average
4,564		33.37% Pervious Area
9,111		66.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry, direct

**Subcatchment 1S-2: 1S-2**

Hydrograph



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Type III 24-hr 100-Year Rainfall=6.70"

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**Summary for Subcatchment 1S-3: 1S-3**

Runoff = 1.03 cfs @ 12.10 hrs, Volume= 0.075 af, Depth= 4.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 100-Year Rainfall=6.70"

	Area (sf)	CN	Description
*	1,256	64	Permeable pavers fire lane, HSG A
*	592	98	Wall, HSG A
*	243	98	Patio above, HSG A
*	1,053	64	Permeable patio, HSG A
*	509	98	Walk, HSG A
*	1,174	98	Area above garage, HSG A
	2,468	74	>75% Grass cover, Good, HSG C
	2,042	76	Gravel roads, HSG A
	9,337	78	Weighted Average
	6,819		73.03% Pervious Area
	2,518		26.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		<b>Sheet Flow, sheet</b>
					Grass: Short n= 0.150 P2= 3.20"
1.0	190	0.0370	3.10		<b>Shallow Concentrated Flow, conc.</b>
					Unpaved Kv= 16.1 fps
6.6	240	Total			

## 217-177 Post Development PSI

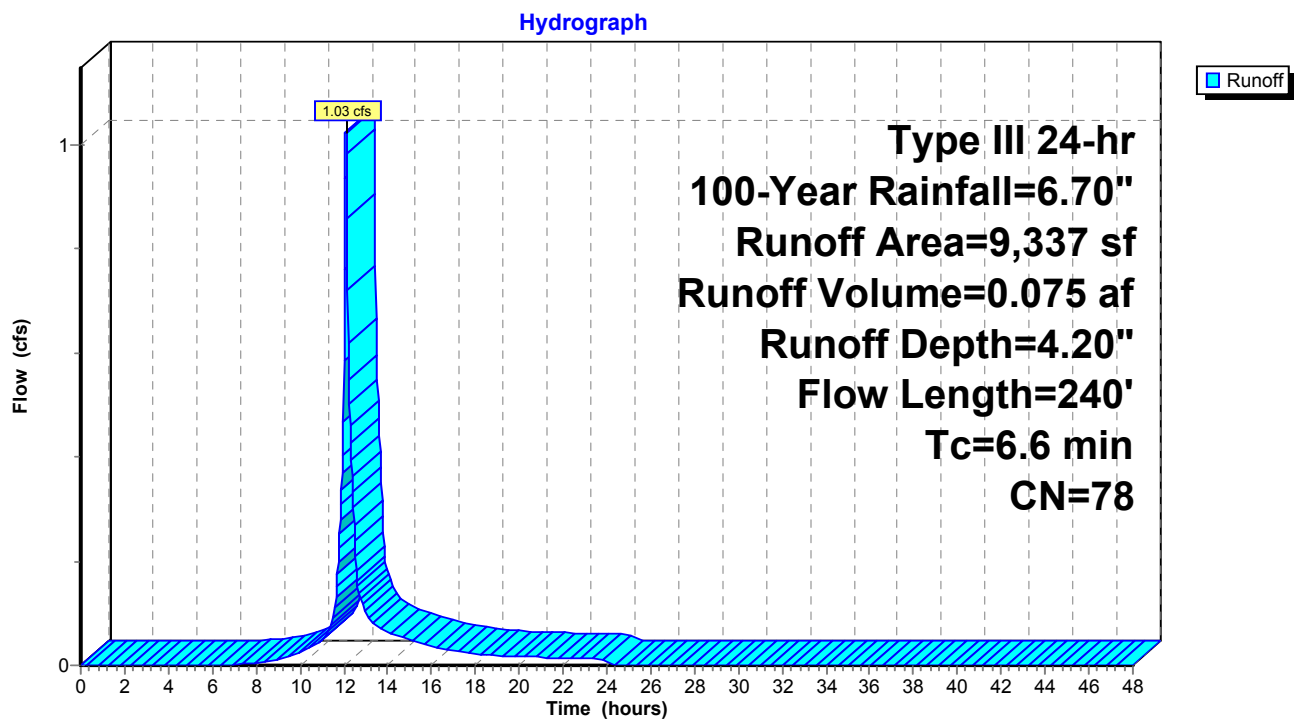
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Type III 24-hr 100-Year Rainfall=6.70"

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### Subcatchment 1S-3: 1S-3



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Type III 24-hr 100-Year Rainfall=6.70"

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**Summary for Subcatchment 1S-4: 1S-4**

Runoff = 0.15 cfs @ 12.12 hrs, Volume= 0.013 af, Depth= 1.34"

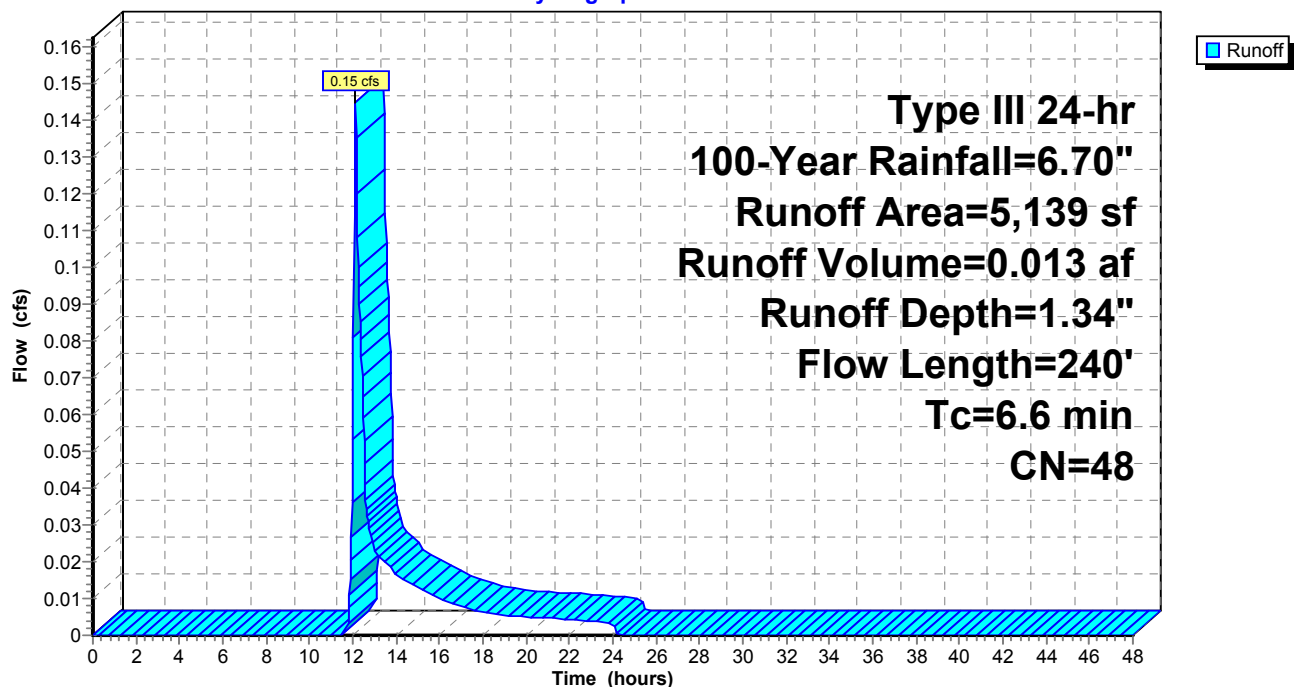
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
4,328	39	>75% Grass cover, Good, HSG A
* 72	98	Wall, HSG A
739	98	Roofs, HSG A
5,139	48	Weighted Average
4,328		84.22% Pervious Area
811		15.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		<b>Sheet Flow, sheet</b>
					Grass: Short n= 0.150 P2= 3.20"
1.0	190	0.0370	3.10		<b>Shallow Concentrated Flow, conc.</b>
					Unpaved Kv= 16.1 fps
6.6	240	Total			

**Subcatchment 1S-4: 1S-4**

Hydrograph



**217-177 Post Development PSI**

Type III 24-hr 100-Year Rainfall=6.70"

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**Summary for Subcatchment 1S-5: Lower Patio**

Runoff = 0.12 cfs @ 12.09 hrs, Volume= 0.010 af, Depth= 6.46"

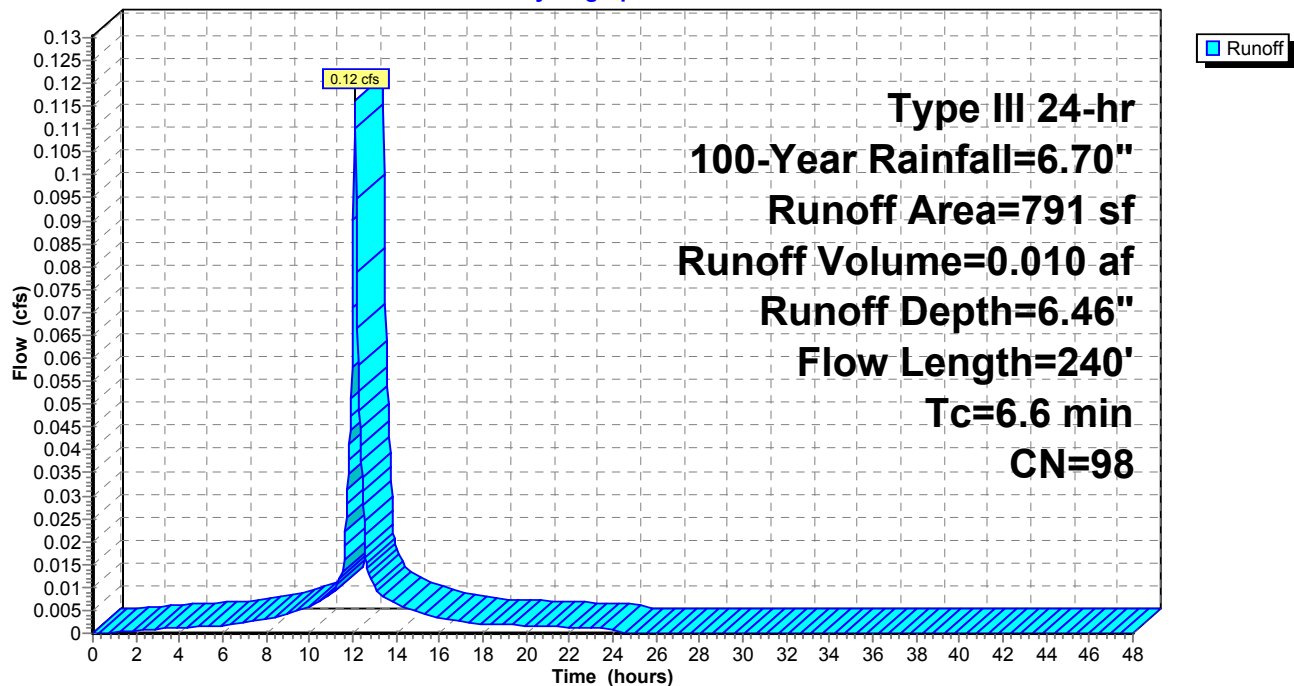
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 100-Year Rainfall=6.70"

	Area (sf)	CN	Description
*	625	98	Bluestone patio, HSG A
*	166	98	Wall, HSG A
	791	98	Weighted Average
	791		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		<b>Sheet Flow, sheet</b>
					Grass: Short n= 0.150 P2= 3.20"
1.0	190	0.0370	3.10		<b>Shallow Concentrated Flow, conc.</b>
					Unpaved Kv= 16.1 fps
6.6	240	Total			

**Subcatchment 1S-5: Lower Patio**

Hydrograph



**217-177 Post Development PSI**

Type III 24-hr 100-Year Rainfall=6.70"

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**Summary for Subcatchment 1S-6: Lower Patio**

Runoff = 0.16 cfs @ 12.10 hrs, Volume= 0.012 af, Depth= 4.20"

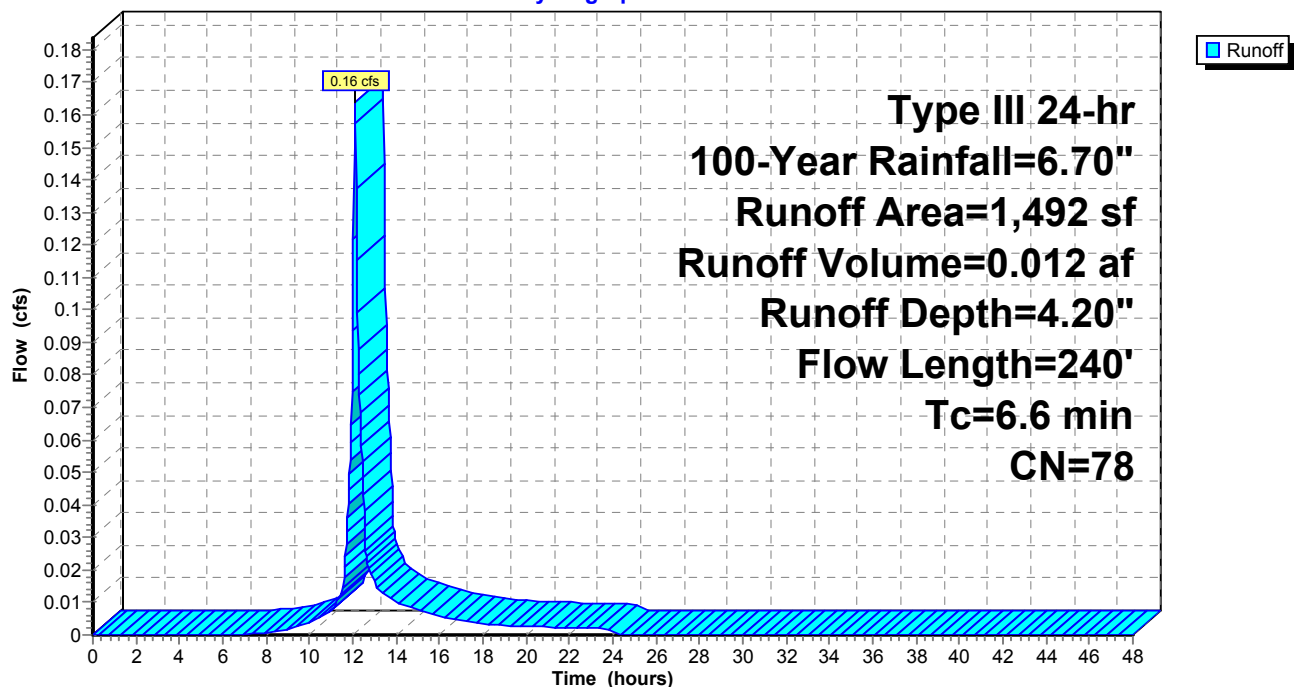
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
500	39	>75% Grass cover, Good, HSG A
* 765	98	Bluestone patio, HSG A
* 120	98	Wall, HSG A
* 9	98	Stepping stones, HSG A
* 98	98	Patio above, HSG A
1,492	78	Weighted Average
500		33.51% Pervious Area
992		66.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		<b>Sheet Flow, sheet</b>
					Grass: Short n= 0.150 P2= 3.20"
1.0	190	0.0370	3.10		<b>Shallow Concentrated Flow, conc.</b>
					Unpaved Kv= 16.1 fps
6.6	240	Total			

**Subcatchment 1S-6: Lower Patio**

Hydrograph



**217-177 Post Development PSI**

Type III 24-hr 100-Year Rainfall=6.70"

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**Summary for Subcatchment 1S-7: Upper Patios**

Runoff = 0.18 cfs @ 12.10 hrs, Volume= 0.013 af, Depth= 4.10"

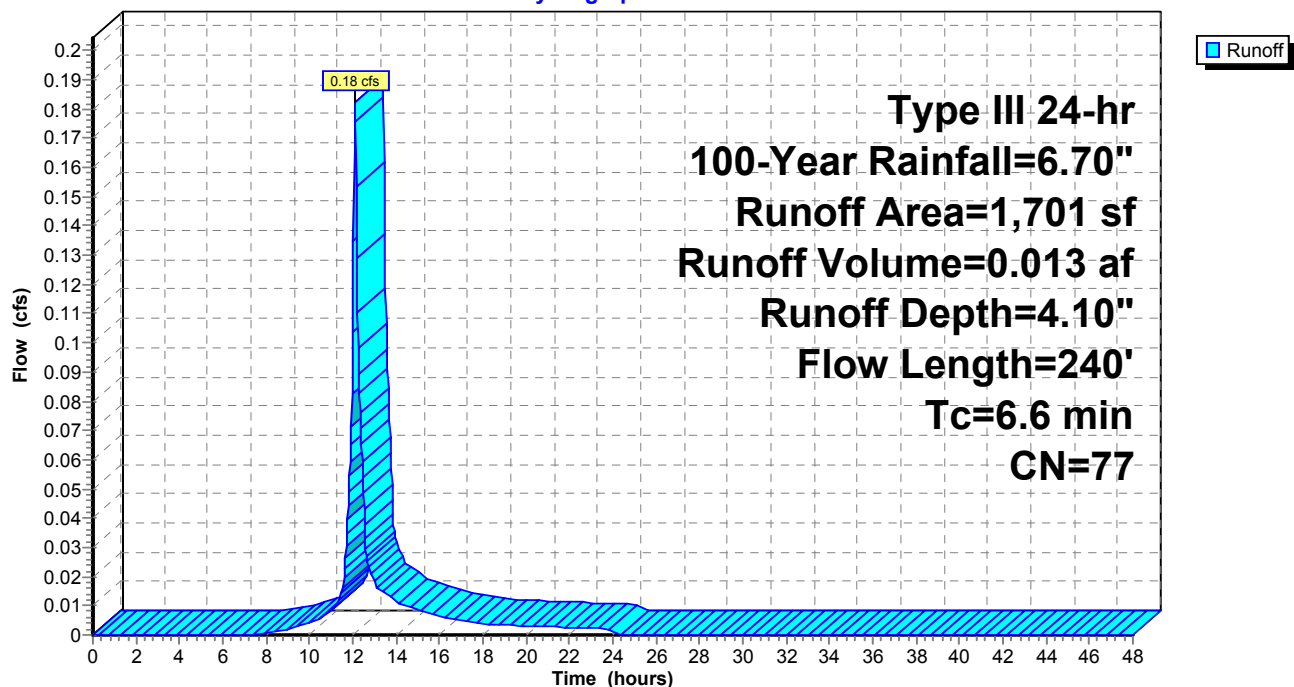
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
615	39	>75% Grass cover, Good, HSG A
* 73	98	Wall, HSG A
* 30	98	Bluestone patio, HSG A
* 970	98	Patio above, HSG A
* 13	98	Stepping stones, HSG A
1,701	77	Weighted Average
615		36.16% Pervious Area
1,086		63.84% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		<b>Sheet Flow, sheet</b>
					Grass: Short n= 0.150 P2= 3.20"
1.0	190	0.0370	3.10		<b>Shallow Concentrated Flow, conc.</b>
					Unpaved Kv= 16.1 fps
6.6	240	Total			

**Subcatchment 1S-7: Upper Patios**

Hydrograph



**217-177 Post Development PSI**

Type III 24-hr 100-Year Rainfall=6.70"

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**Summary for Subcatchment 1S-8: 1S-8**

Runoff = 0.00 cfs @ 12.28 hrs, Volume= 0.000 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 100-Year Rainfall=6.70"

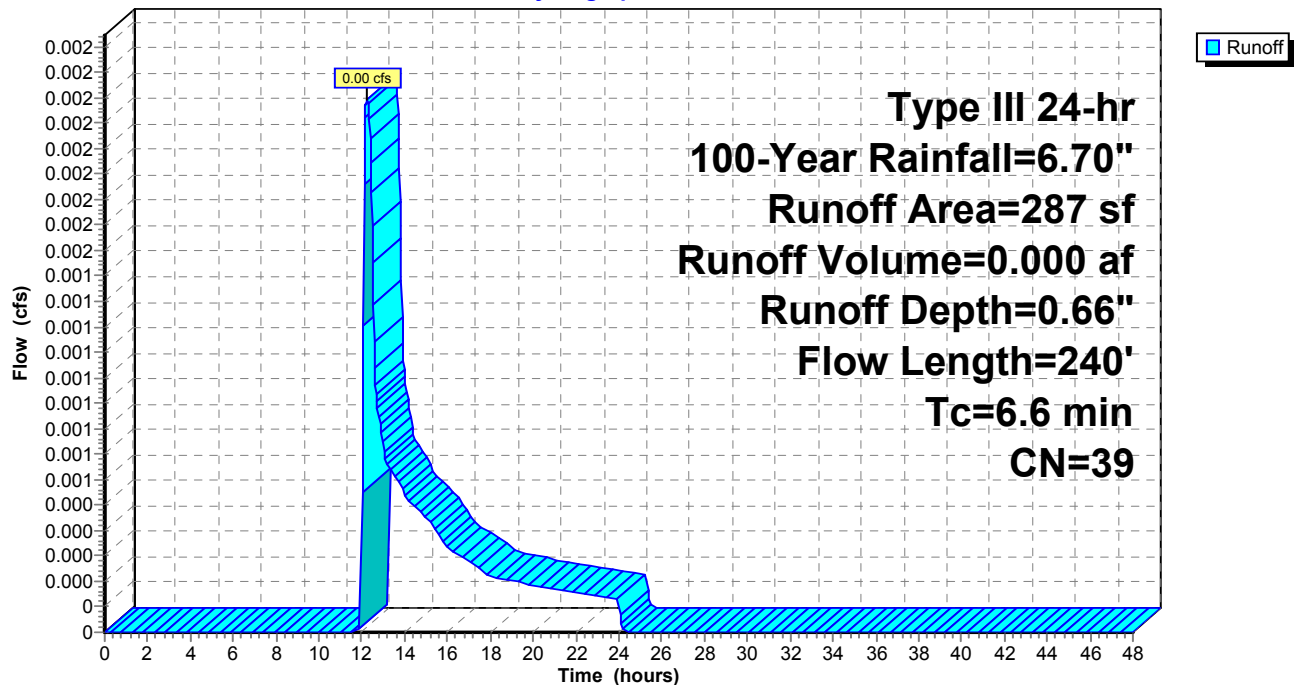
Area (sf)	CN	Description
287	39	>75% Grass cover, Good, HSG A
287		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		<b>Sheet Flow, sheet</b>
					Grass: Short n= 0.150 P2= 3.20"
1.0	190	0.0370	3.10		<b>Shallow Concentrated Flow, conc.</b>
					Unpaved Kv= 16.1 fps
6.6	240	Total			

**Subcatchment 1S-8: 1S-8**

Hydrograph



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Type III 24-hr 100-Year Rainfall=6.70"

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### Summary for Subcatchment R-1: ROOF

Runoff = 1.12 cfs @ 12.07 hrs, Volume= 0.089 af, Depth= 6.46"

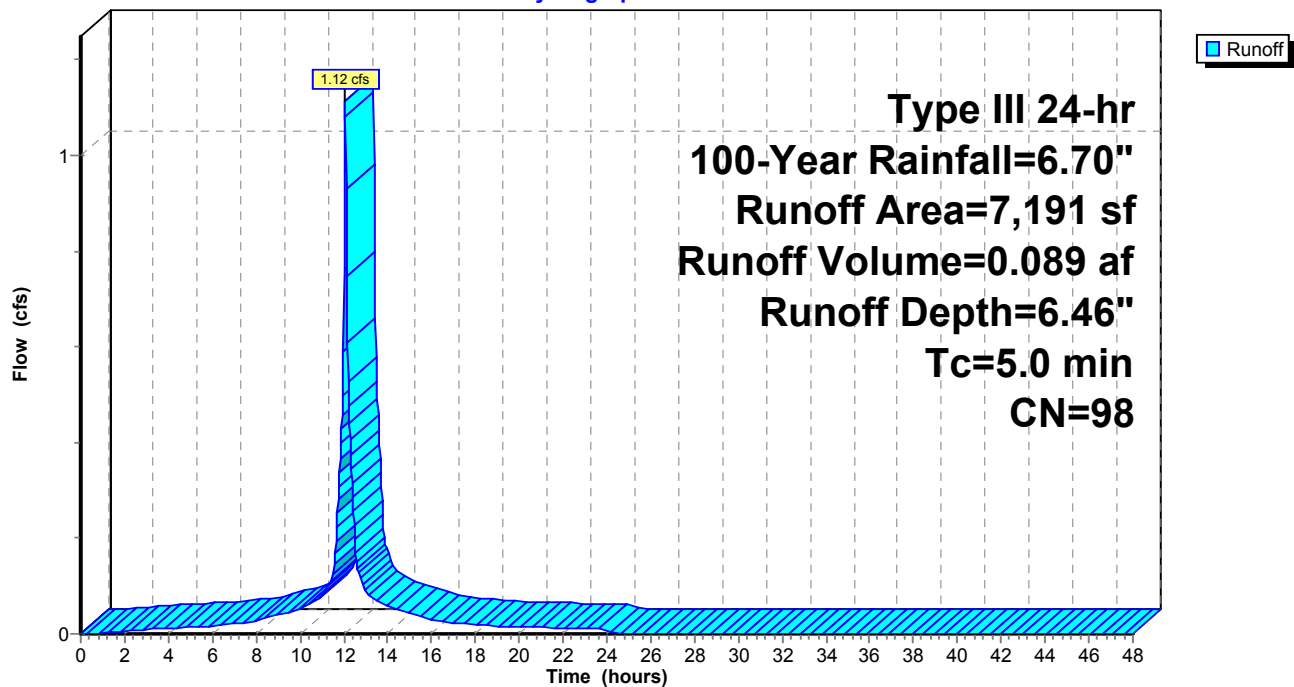
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
7,191	98	Unconnected roofs, HSG A
7,191		100.00% Impervious Area
7,191		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry, direct

### Subcatchment R-1: ROOF

Hydrograph



## 217-177 Post Development PSI

Type III 24-hr 100-Year Rainfall=6.70"

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### Summary for Subcatchment R-2: ROOF

Runoff = 2.09 cfs @ 12.07 hrs, Volume= 0.167 af, Depth= 6.46"

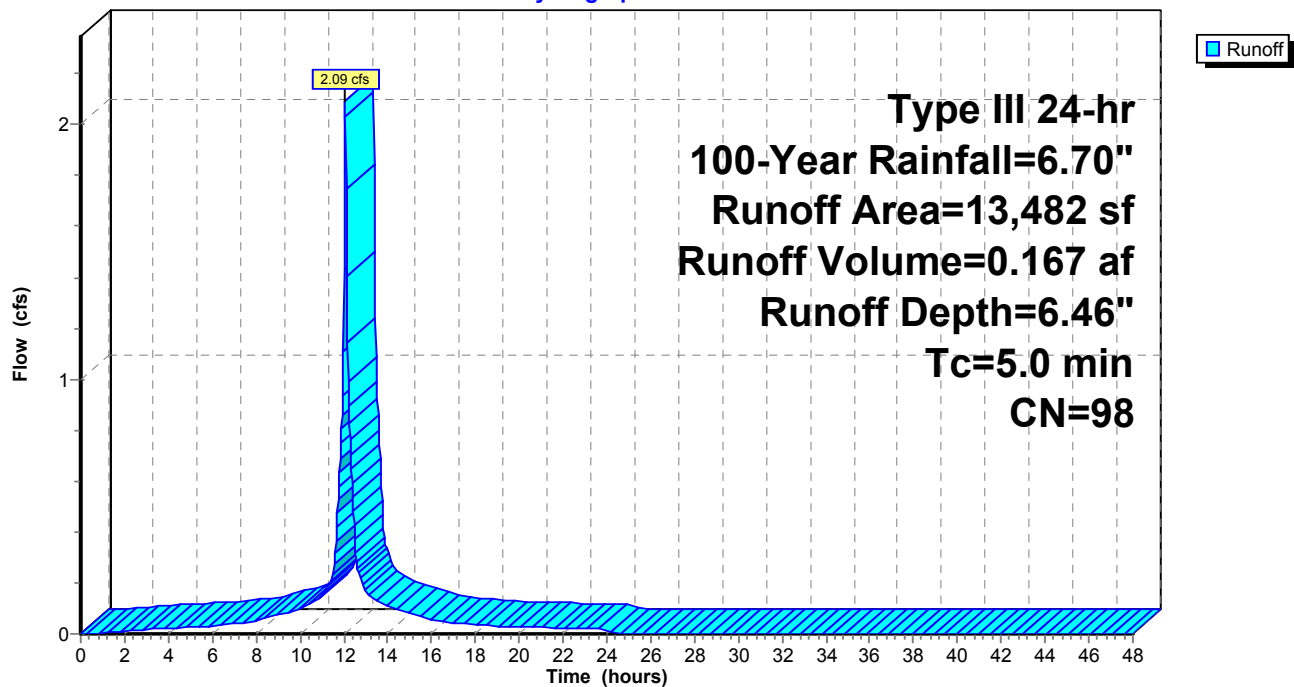
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs  
Type III 24-hr 100-Year Rainfall=6.70"

Area (sf)	CN	Description
13,482	98	Unconnected roofs, HSG A
13,482		100.00% Impervious Area
13,482		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry, direct

### Subcatchment R-2: ROOF

Hydrograph



## 217-177 Post Development PSI

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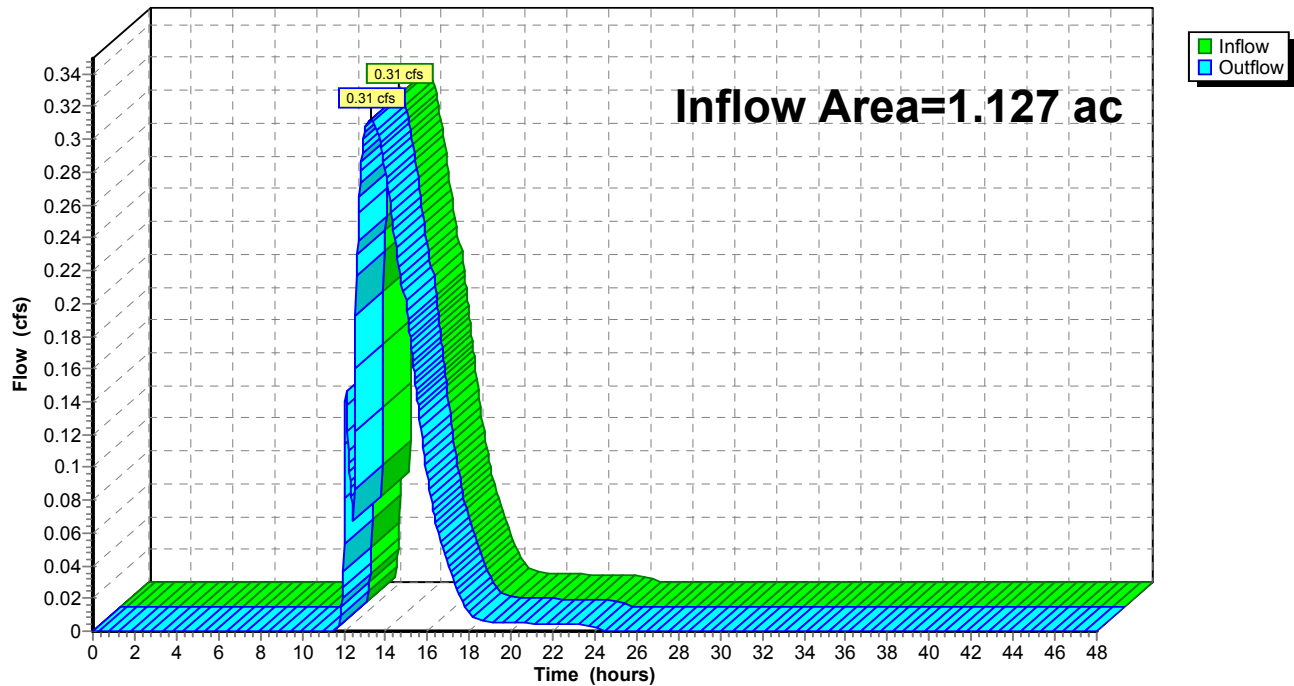
### Summary for Reach DP-1: DP-1

Inflow Area = 1.127 ac, 67.42% Impervious, Inflow Depth = 0.86" for 100-Year event  
Inflow = 0.31 cfs @ 13.25 hrs, Volume= 0.081 af  
Outflow = 0.31 cfs @ 13.25 hrs, Volume= 0.081 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs / 3

### Reach DP-1: DP-1

Hydrograph



**217-177 Post Development PSI**

Type III 24-hr 100-Year Rainfall=6.70"

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**Summary for Pond D-1: Area Behind Wall**

Inflow Area = 1.801 ac, 2.48% Impervious, Inflow Depth = 0.53" for 100-Year event  
 Inflow = 0.36 cfs @ 12.49 hrs, Volume= 0.080 af  
 Outflow = 0.25 cfs @ 12.73 hrs, Volume= 0.080 af, Atten= 31%, Lag= 14.4 min  
 Primary = 0.25 cfs @ 12.73 hrs, Volume= 0.080 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs / 3  
 Peak Elev= 148.62' @ 12.73 hrs Surf.Area= 460 sf Storage= 195 cf

Plug-Flow detention time= 5.4 min calculated for 0.080 af (100% of inflow)  
 Center-of-Mass det. time= 5.4 min ( 969.2 - 963.8 )

Volume	Invert	Avail.Storage	Storage Description
#1	148.00'	1,496 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
148.00	173	0	0
149.00	637	405	405
150.00	1,545	1,091	1,496

Device	Routing	Invert	Outlet Devices
#1	Primary	148.00'	<b>2.0" Horiz. Orifice/Grate X 3.00</b> C= 0.600 Limited to weir flow at low heads

**Primary OutFlow** Max=0.25 cfs @ 12.73 hrs HW=148.62' TW=139.41' (Dynamic Tailwater)  
 ↑ **1=Orifice/Grate** (Orifice Controls 0.25 cfs @ 3.78 fps)

## 217-177 Post Development PSI

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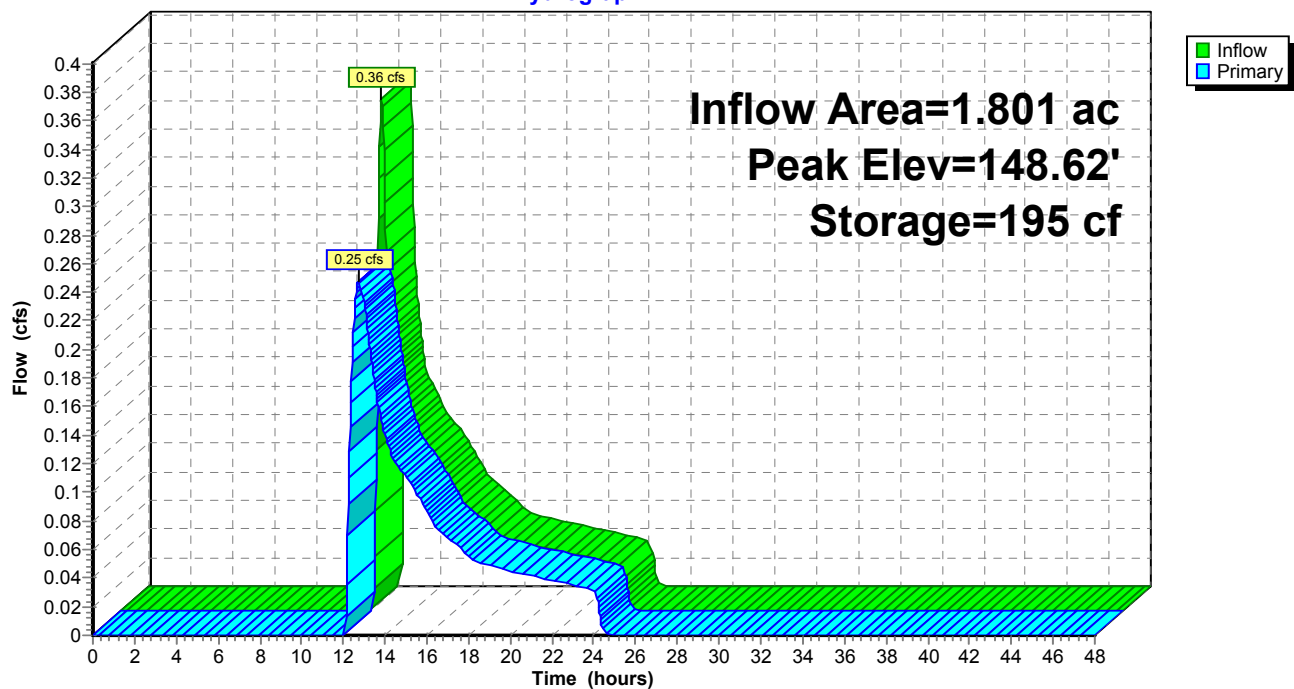
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Type III 24-hr 100-Year Rainfall=6.70"

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### Pond D-1: Area Behind Wall

Hydrograph



## 217-177 Post Development PSI

Type III 24-hr 100-Year Rainfall=6.70"

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### Summary for Pond DMH-1: DMH-2

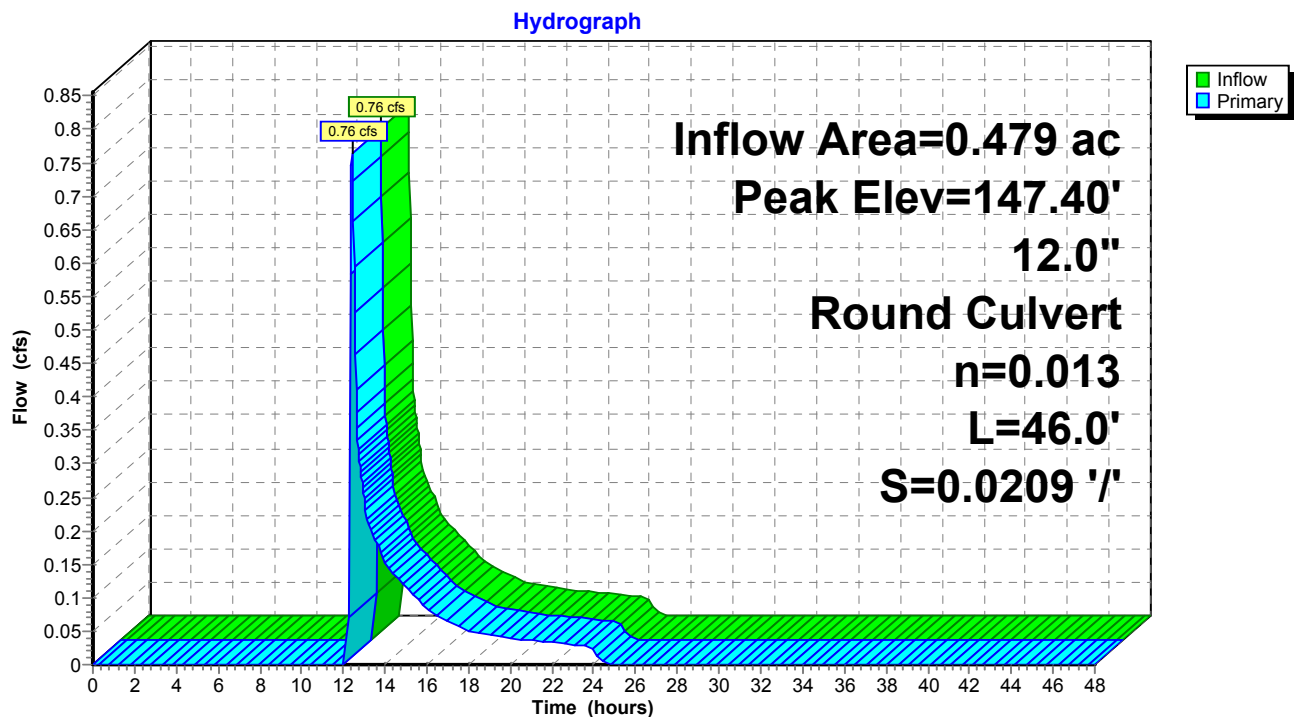
Inflow Area = 0.479 ac, 78.13% Impervious, Inflow Depth = 2.21" for 100-Year event  
Inflow = 0.76 cfs @ 12.41 hrs, Volume= 0.088 af  
Outflow = 0.76 cfs @ 12.41 hrs, Volume= 0.088 af, Atten= 0%, Lag= 0.0 min  
Primary = 0.76 cfs @ 12.41 hrs, Volume= 0.088 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs / 3  
Peak Elev= 147.40' @ 12.41 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	146.96'	<b>12.0" Round Culvert</b> L= 46.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 146.96' / 146.00' S= 0.0209 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.76 cfs @ 12.41 hrs HW=147.40' TW=146.41' (Dynamic Tailwater)  
↑1=Culvert (Inlet Controls 0.76 cfs @ 2.27 fps)

### Pond DMH-1: DMH-2



**217-177 Post Development PSI**

Type III 24-hr 100-Year Rainfall=6.70"

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**Summary for Pond P-1: ACF R-Tank SD Infiltration System**

Inflow Area = 1.939 ac, 8.11% Impervious, Inflow Depth = 0.91" for 100-Year event  
 Inflow = 0.89 cfs @ 12.07 hrs, Volume= 0.147 af  
 Outflow = 0.21 cfs @ 11.79 hrs, Volume= 0.147 af, Atten= 77%, Lag= 0.0 min  
 Discarded = 0.21 cfs @ 11.79 hrs, Volume= 0.147 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs / 3  
 Peak Elev= 139.95' @ 13.74 hrs Surf.Area= 1,087 sf Storage= 1,113 cf

Plug-Flow detention time= 39.5 min calculated for 0.147 af (100% of inflow)  
 Center-of-Mass det. time= 39.4 min ( 919.8 - 880.3 )

Volume	Invert	Avail.Storage	Storage Description
#1A	138.20'	664 cf	<b>22.37'W x 48.57'L x 2.12'H Field A</b> 2,304 cf Overall - 645 cf Embedded = 1,660 cf x 40.0% Voids
#2A	138.53'	613 cf	<b>ACF R-Tank SD 1 x 266 Inside #1</b> Inside= 15.7"W x 9.4"H => 0.98 sf x 2.35'L = 2.3 cf Outside= 15.7"W x 9.4"H => 1.03 sf x 2.35'L = 2.4 cf 14 Rows of 19 Chambers
		1,276 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	138.20'	<b>8.270 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'

**Discarded OutFlow** Max=0.21 cfs @ 11.79 hrs HW=138.23' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.21 cfs)

## 217-177 Post Development PSI

Type III 24-hr 100-Year Rainfall=6.70"

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### Pond P-1: ACF R-Tank SD Infiltration System - Chamber Wizard Field A

#### Chamber Model = ACF R-Tank SD 1 (ACF Environmental R-Tank SD)

Inside= 15.7"W x 9.4"H => 0.98 sf x 2.35'L = 2.3 cf

Outside= 15.7"W x 9.4"H => 1.03 sf x 2.35'L = 2.4 cf

19 Chambers/Row x 2.35' Long = 44.57' Row Length +24.0" End Stone x 2 = 48.57' Base Length

14 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 22.37' Base Width

4.0" Base + 9.4" Chamber Height + 12.0" Cover = 2.12' Field Height

266 Chambers x 2.3 cf = 612.5 cf Chamber Storage

266 Chambers x 2.4 cf = 644.8 cf Displacement

2,304.5 cf Field - 644.8 cf Chambers = 1,659.7 cf Stone x 40.0% Voids = 663.9 cf Stone Storage

Chamber Storage + Stone Storage = 1,276.4 cf = 0.029 af

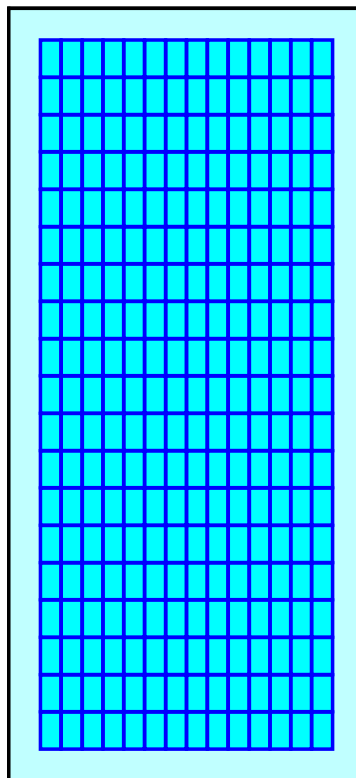
Overall Storage Efficiency = 55.4%

Overall System Size = 48.57' x 22.37' x 2.12'

266 Chambers

85.4 cy Field

61.5 cy Stone



## 217-177 Post Development PSI

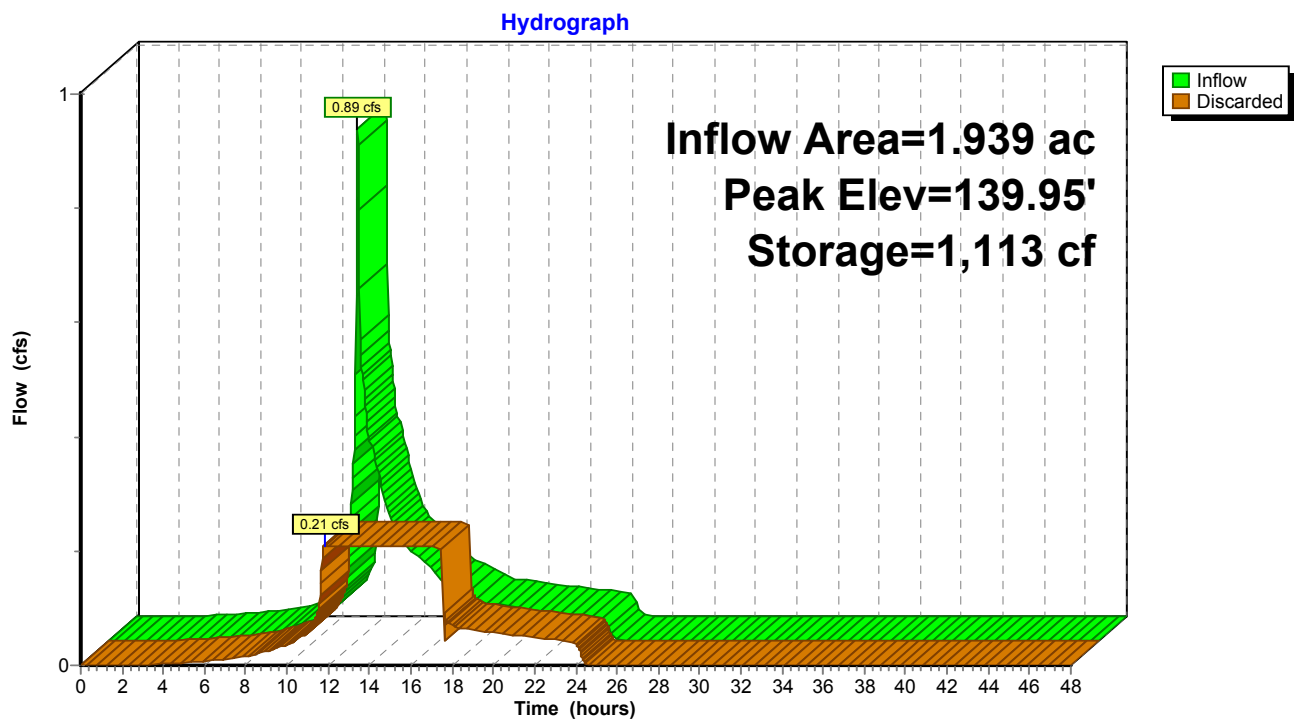
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Type III 24-hr 100-Year Rainfall=6.70"

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### Pond P-1: ACF R-Tank SD Infiltration System



**217-177 Post Development PSI**

Type III 24-hr 100-Year Rainfall=6.70"

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**Summary for Pond P-2: Cultec Infiltration System**

Inflow Area = 0.479 ac, 78.13% Impervious, Inflow Depth = 4.98" for 100-Year event  
 Inflow = 2.70 cfs @ 12.07 hrs, Volume= 0.199 af  
 Outflow = 0.76 cfs @ 12.41 hrs, Volume= 0.136 af, Atten= 72%, Lag= 20.5 min  
 Discarded = 0.27 cfs @ 11.61 hrs, Volume= 0.047 af  
 Primary = 0.76 cfs @ 12.41 hrs, Volume= 0.088 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs / 3

Peak Elev= 149.50' @ 12.41 hrs Surf.Area= 1,531 sf Storage= 2,895 cf

Plug-Flow detention time= 130.9 min calculated for 0.136 af (68% of inflow)

Center-of-Mass det. time= 32.4 min ( 814.3 - 781.9 )

Volume	Invert	Avail.Storage	Storage Description
#1A	146.80'	1,317 cf	<b>20.83'W x 73.50'L x 3.54'H Field A</b> 5,423 cf Overall - 2,131 cf Embedded = 3,292 cf x 40.0% Voids
#2A	147.30'	2,131 cf	<b>Cultec R-330XLHD x 40 Inside #1</b> Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 4 rows
		3,448 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	147.13'	<b>12.0" Round 147.13</b> L= 17.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 147.13' / 146.96' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	149.35'	<b>4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)</b>
#3	Discarded	146.80'	<b>Special &amp; User-Defined</b> Head (feet) 0.00 0.10 0.50 1.00 1.50 1.51 1.52 2.00 3.54 Disch. (cfs) 0.000 0.270 0.270 0.270 0.270 0.270 0.000 0.000 0.000

**Discarded OutFlow** Max=0.27 cfs @ 11.61 hrs HW=146.91' (Free Discharge)↑**3=Special & User-Defined** (Custom Controls 0.27 cfs)**Primary OutFlow** Max=0.76 cfs @ 12.41 hrs HW=149.50' TW=147.40' (Dynamic Tailwater)↑**1=147.13** (Passes 0.76 cfs of 4.08 cfs potential flow)↑**2=Sharp-Crested Rectangular Weir**(Weir Controls 0.76 cfs @ 1.27 fps)

## 217-177 Post Development PSI

Type III 24-hr 100-Year Rainfall=6.70"

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### Pond P-2: Cultec Infiltration System - Chamber Wizard Field A

#### Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 4 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

10 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 71.50' Row Length +12.0" End Stone x 2 = 73.50' Base Length

4 Rows x 52.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 20.83' Base Width

6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

40 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 4 Rows = 2,131.0 cf Chamber Storage

5,423.2 cf Field - 2,131.0 cf Chambers = 3,292.2 cf Stone x 40.0% Voids = 1,316.9 cf Stone Storage

Chamber Storage + Stone Storage = 3,447.9 cf = 0.079 af

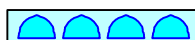
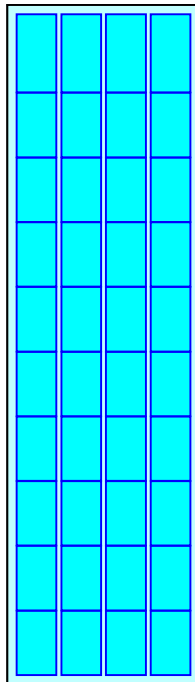
Overall Storage Efficiency = 63.6%

Overall System Size = 73.50' x 20.83' x 3.54'

40 Chambers

200.9 cy Field

121.9 cy Stone



## 217-177 Post Development PSI

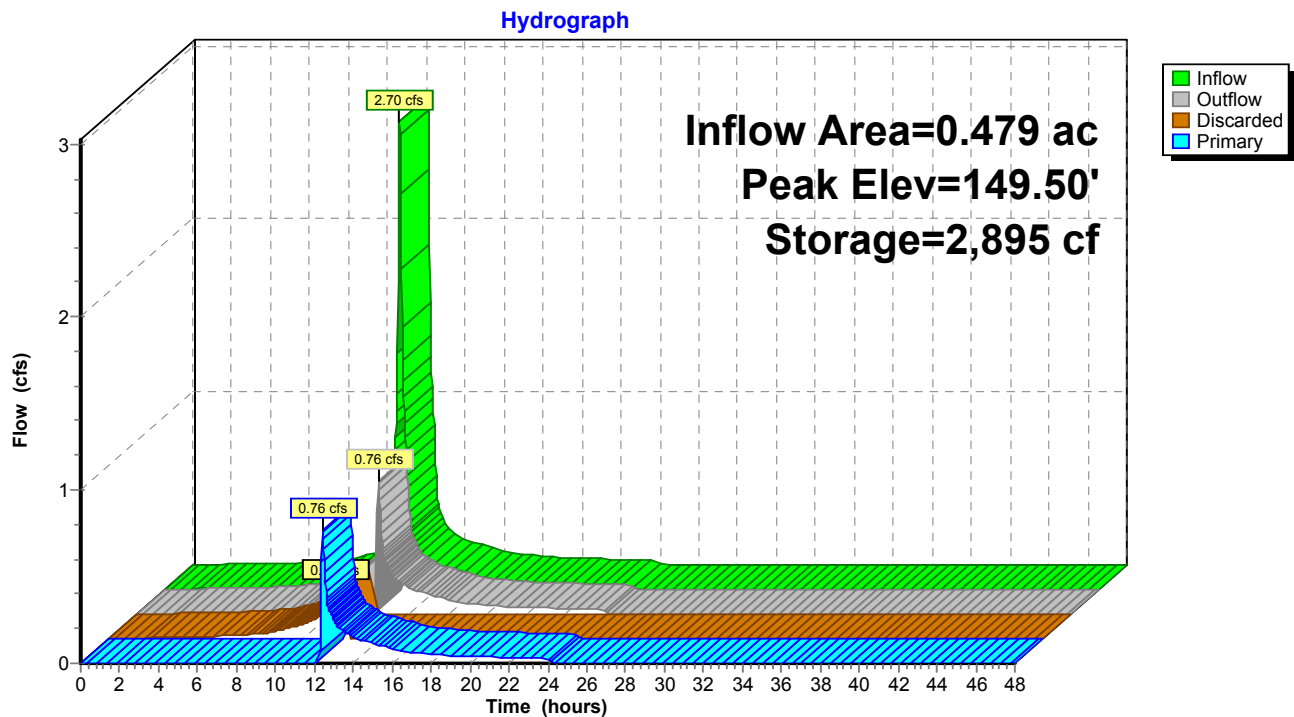
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Type III 24-hr 100-Year Rainfall=6.70"

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### Pond P-2: Cultec Infiltration System



**217-177 Post Development PSI**

Type III 24-hr 100-Year Rainfall=6.70"

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**Summary for Pond P-3: Cultec Infiltration System**

Inflow Area = 1.003 ac, 73.94% Impervious, Inflow Depth = 3.95" for 100-Year event  
 Inflow = 3.08 cfs @ 12.08 hrs, Volume= 0.330 af  
 Outflow = 0.43 cfs @ 13.29 hrs, Volume= 0.330 af, Atten= 86%, Lag= 72.8 min  
 Discarded = 0.14 cfs @ 10.71 hrs, Volume= 0.262 af  
 Primary = 0.29 cfs @ 13.29 hrs, Volume= 0.067 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs / 3

Peak Elev= 147.28' @ 13.29 hrs Surf.Area= 2,477 sf Storage= 5,369 cf

Plug-Flow detention time= 264.7 min calculated for 0.330 af (100% of inflow)

Center-of-Mass det. time= 264.8 min ( 1,074.5 - 809.7 )

Volume	Invert	Avail.Storage	Storage Description
#1A	144.00'	2,095 cf	<b>64.33'W x 38.50'L x 3.54'H Field A</b> 8,772 cf Overall - 3,535 cf Embedded = 5,237 cf x 40.0% Voids
#2A	144.50'	3,535 cf	<b>Cultec R-330XLHD x 65 Inside #1</b> Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 13 rows
		5,630 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	146.50'	<b>4.0" Round Culvert</b> L= 14.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 146.50' / 146.36' S= 0.0100 ' / Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.09 sf
#2	Discarded	144.00'	<b>2.410 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'

**Discarded OutFlow** Max=0.14 cfs @ 10.71 hrs HW=144.04' (Free Discharge)↑ **2=Exfiltration** (Exfiltration Controls 0.14 cfs)**Primary OutFlow** Max=0.29 cfs @ 13.29 hrs HW=147.28' TW=0.00' (Dynamic Tailwater)↑ **1=Culvert** (Barrel Controls 0.29 cfs @ 3.33 fps)

## 217-177 Post Development PSI

Type III 24-hr 100-Year Rainfall=6.70"

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### Pond P-3: Cultec Infiltration System - Chamber Wizard Field A

#### Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 13 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

5 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 36.50' Row Length +12.0" End Stone x 2 = 38.50' Base Length

13 Rows x 52.0" Wide + 6.0" Spacing x 12 + 12.0" Side Stone x 2 = 64.33' Base Width

6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

65 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 13 Rows = 3,535.5 cf Chamber Storage

8,772.1 cf Field - 3,535.5 cf Chambers = 5,236.6 cf Stone x 40.0% Voids = 2,094.6 cf Stone Storage

Chamber Storage + Stone Storage = 5,630.1 cf = 0.129 af

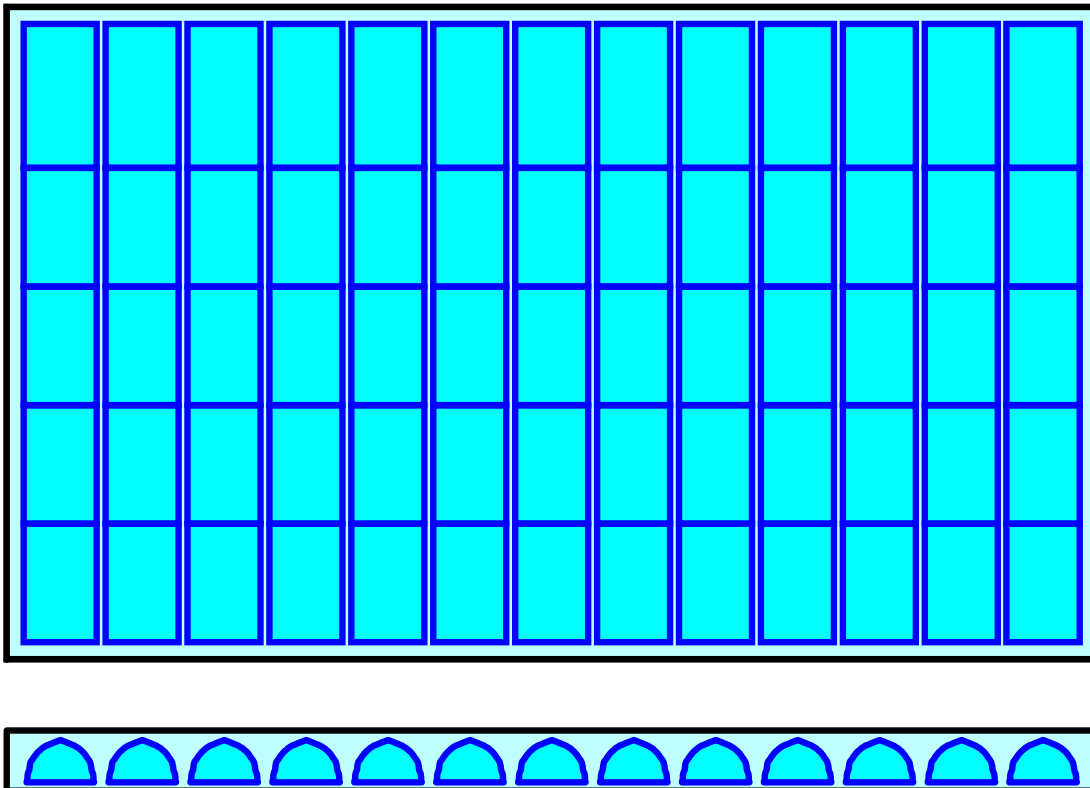
Overall Storage Efficiency = 64.2%

Overall System Size = 38.50' x 64.33' x 3.54'

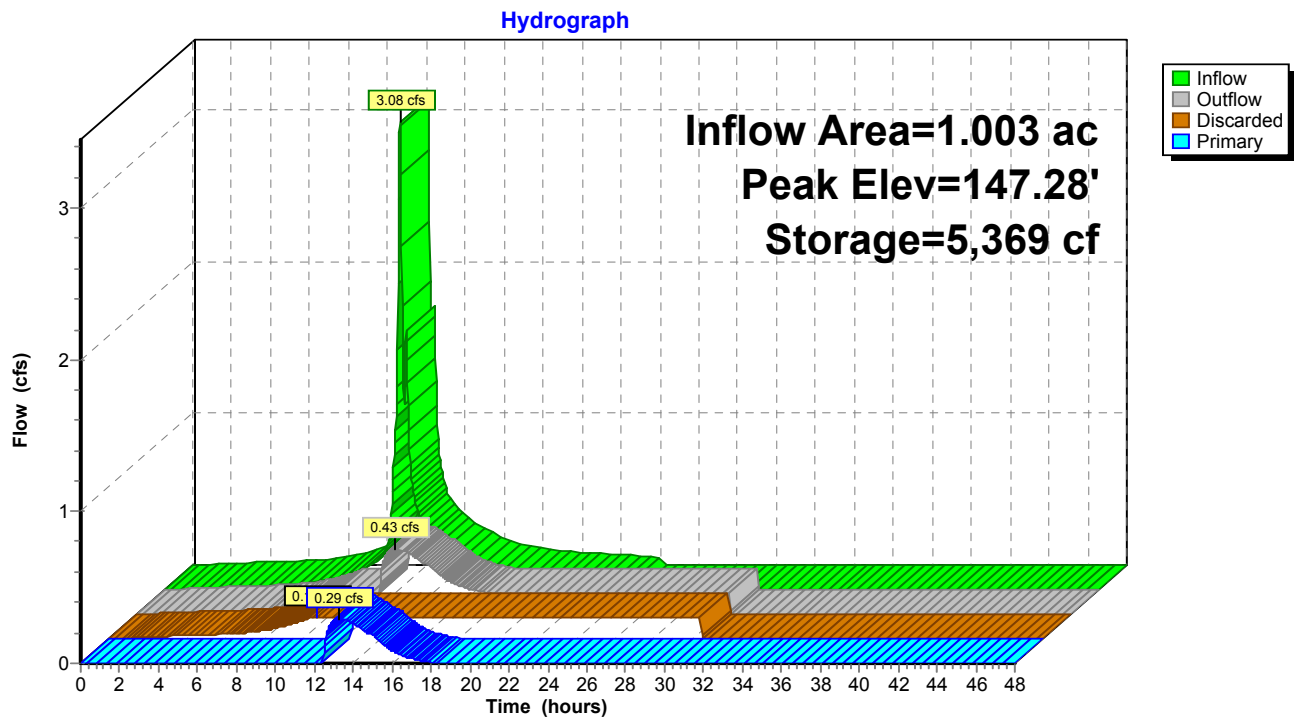
65 Chambers

324.9 cy Field

193.9 cy Stone



### Pond P-3: Cultec Infiltration System



**Summary for Pond P-4: ACF R-Tank SD Infiltration System**

Inflow Area = 0.052 ac, 78.10% Impervious, Inflow Depth = 4.99" for 100-Year event  
 Inflow = 0.28 cfs @ 12.09 hrs, Volume= 0.022 af  
 Outflow = 0.02 cfs @ 11.43 hrs, Volume= 0.022 af, Atten= 93%, Lag= 0.0 min  
 Discarded = 0.02 cfs @ 11.43 hrs, Volume= 0.022 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs / 3  
 Peak Elev= 140.00' @ 13.50 hrs Surf.Area= 364 sf Storage= 379 cf

Plug-Flow detention time= 151.9 min calculated for 0.022 af (100% of inflow)  
 Center-of-Mass det. time= 151.9 min ( 935.1 - 783.2 )

Volume	Invert	Avail.Storage	Storage Description
#1A	138.00'	234 cf	<b>10.56'W x 34.50'L x 2.04'H Field A</b> 742 cf Overall - 158 cf Embedded = 585 cf x 40.0% Voids
#2A	138.25'	150 cf	<b>ACF R-Tank SD 1 x 65 Inside #1</b> Inside= 15.7"W x 9.4"H => 0.98 sf x 2.35'L = 2.3 cf Outside= 15.7"W x 9.4"H => 1.03 sf x 2.35'L = 2.4 cf 5 Rows of 13 Chambers
		384 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	138.00'	<b>2.410 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'

**Discarded OutFlow** Max=0.02 cfs @ 11.43 hrs HW=138.02' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

**Pond P-4: ACF R-Tank SD Infiltration System - Chamber Wizard Field A****Chamber Model = ACF R-Tank SD 1 (ACF Environmental R-Tank SD)**

Inside= 15.7"W x 9.4"H =&gt; 0.98 sf x 2.35'L = 2.3 cf

Outside= 15.7"W x 9.4"H =&gt; 1.03 sf x 2.35'L = 2.4 cf

13 Chambers/Row x 2.35' Long = 30.50' Row Length +24.0" End Stone x 2 = 34.50' Base Length

5 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 10.56' Base Width

3.0" Base + 9.4" Chamber Height + 12.0" Cover = 2.04' Field Height

65 Chambers x 2.3 cf = 149.7 cf Chamber Storage

65 Chambers x 2.4 cf = 157.6 cf Displacement

742.3 cf Field - 157.6 cf Chambers = 584.7 cf Stone x 40.0% Voids = 233.9 cf Stone Storage

Chamber Storage + Stone Storage = 383.6 cf = 0.009 af

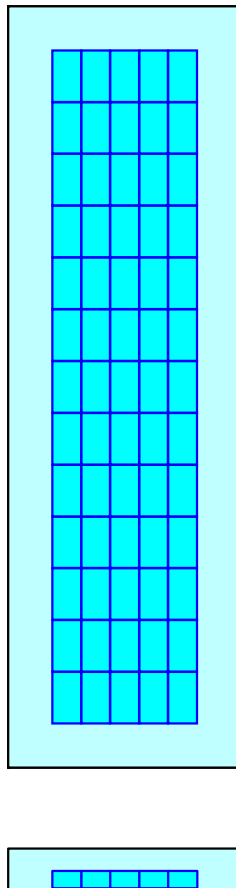
Overall Storage Efficiency = 51.7%

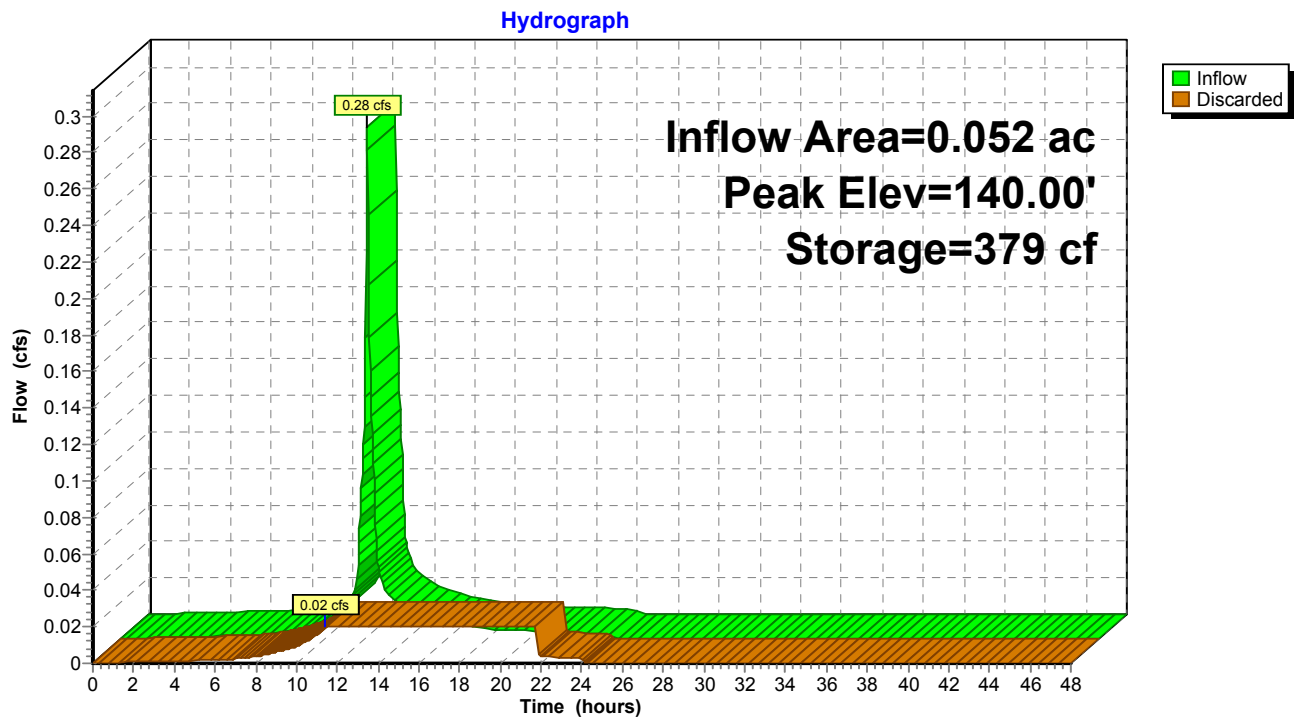
Overall System Size = 34.50' x 10.56' x 2.04'

65 Chambers

27.5 cy Field

21.7 cy Stone



**Pond P-4: ACF R-Tank SD Infiltration System**

**217-177 Post Development PSI**

Type III 24-hr 100-Year Rainfall=6.70"

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**Summary for Pond P-5: Cultec Infiltration System**

Inflow Area = 0.039 ac, 63.84% Impervious, Inflow Depth = 4.10" for 100-Year event  
 Inflow = 0.18 cfs @ 12.10 hrs, Volume= 0.013 af  
 Outflow = 0.01 cfs @ 11.49 hrs, Volume= 0.013 af, Atten= 95%, Lag= 0.0 min  
 Discarded = 0.01 cfs @ 11.49 hrs, Volume= 0.013 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.03 hrs / 3  
 Peak Elev= 149.46' @ 15.06 hrs Surf.Area= 155 sf Storage= 295 cf

Plug-Flow detention time= 330.9 min calculated for 0.013 af (100% of inflow)  
 Center-of-Mass det. time= 330.9 min ( 1,148.4 - 817.5 )

Volume	Invert	Avail.Storage	Storage Description
#1A	147.50'	363 cf	<b>6.33'W x 24.50'L x 3.54'H Field A</b> 550 cf Overall - 168 cf Embedded = 382 cf x 95.0% Voids
#2A	148.00'	168 cf	<b>Cultec R-330XLHD x 3 Inside #1</b> Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 1 rows
		530 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	147.50'	<b>2.410 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'

**Discarded OutFlow** Max=0.01 cfs @ 11.49 hrs HW=147.54' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

**Pond P-5: Cultec Infiltration System - Chamber Wizard Field A****Chamber Model = Cultec R-330XLHD (Cultec Recharger®330XLHD)**

Effective Size= 47.8"W x 30.0"H =&gt; 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 1 rows

3 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 22.50' Row Length +12.0" End Stone x 2 = 24.50'  
Base Length

1 Rows x 52.0" Wide + 12.0" Side Stone x 2 = 6.33' Base Width

6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

3 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 1 Rows = 167.6 cf Chamber Storage

549.5 cf Field - 167.6 cf Chambers = 381.9 cf Stone x 95.0% Voids = 362.8 cf Stone Storage

Chamber Storage + Stone Storage = 530.5 cf = 0.012 af

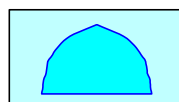
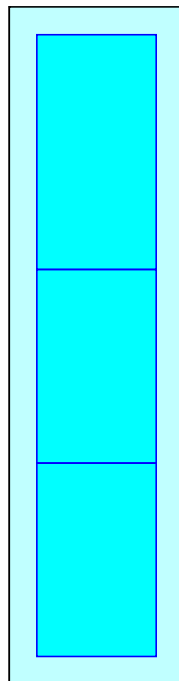
Overall Storage Efficiency = 96.5%

Overall System Size = 24.50' x 6.33' x 3.54'

3 Chambers

20.4 cy Field

14.1 cy Stone



## 217-177 Post Development PSI

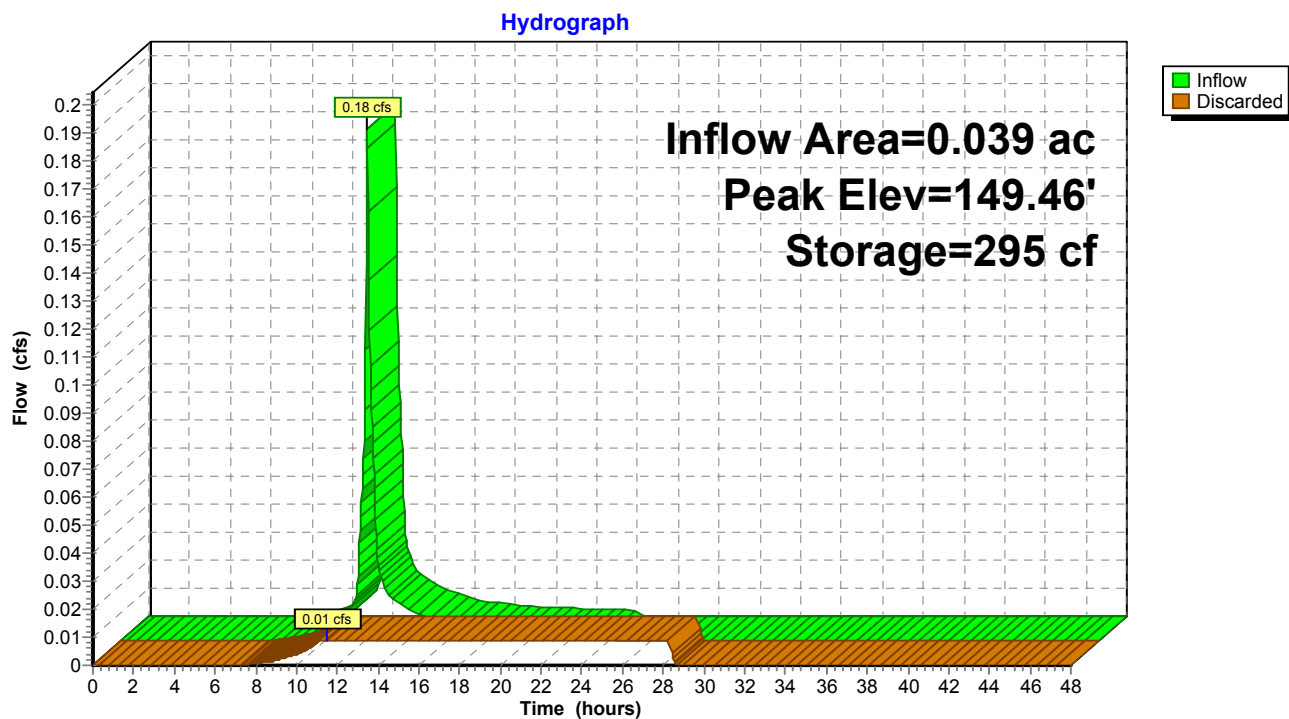
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### Pond P-5: Cultec Infiltration System



## **A P P E N D I X C**

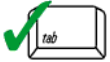
### **Checklist for Stormwater Report**



# Checklist for Stormwater Report

## A. Introduction

**Important:** When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the [Massachusetts Stormwater Handbook](#). The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.<sup>1</sup> This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8<sup>2</sup>
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

<sup>1</sup> The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

<sup>2</sup> For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.



# Checklist for Stormwater Report

## B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

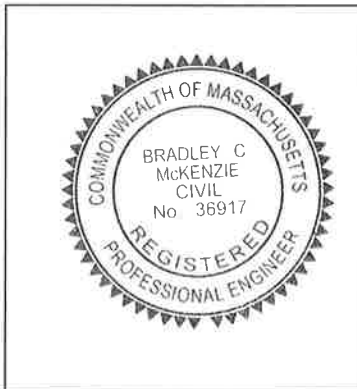
*Note:* Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

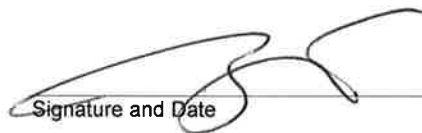
A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

### Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature



  
Signature and Date

2-28-2020

## Checklist

**Project Type:** Is the application for new development, redevelopment, or a mix of new and redevelopment?

- ☐ New development
- ☒ Redevelopment
- ☐ Mix of New Development and Redevelopment



# Checklist for Stormwater Report

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## Checklist (continued)

**LID Measures:** Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- ☒ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☐ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☐ Use of “country drainage” versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☒ Other (describe): Infiltration Chambers

## Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☐ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.



# Checklist for Stormwater Report

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## Checklist (continued)

### Standard 2: Peak Rate Attenuation

- ☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.
- ☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.
- ☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

### Standard 3: Recharge

- ☒ Soil Analysis provided.
- ☒ Required Recharge Volume calculation provided.
- ☐ Required Recharge volume reduced through use of the LID site Design Credits.
- ☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.
  - ☒ Static
  - ☐ Simple Dynamic
  - ☐ Dynamic Field<sup>1</sup>
- ☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.
- ☒ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.
- ☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.
- ☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:
  - ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
  - ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
  - ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
  - ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.
- ☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.
- ☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

---

<sup>1</sup> 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.



# Checklist for Stormwater Report

---

## Checklist (continued)

### Standard 3: Recharge (continued)

- ☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.
- ☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

### Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
  - Provisions for storing materials and waste products inside or under cover;
  - Vehicle washing controls;
  - Requirements for routine inspections and maintenance of stormwater BMPs;
  - Spill prevention and response plans;
  - Provisions for maintenance of lawns, gardens, and other landscaped areas;
  - Requirements for storage and use of fertilizers, herbicides, and pesticides;
  - Pet waste management provisions;
  - Provisions for operation and management of septic systems;
  - Provisions for solid waste management;
  - Snow disposal and plowing plans relative to Wetland Resource Areas;
  - Winter Road Salt and/or Sand Use and Storage restrictions;
  - Street sweeping schedules;
  - Provisions for prevention of illicit discharges to the stormwater management system;
  - Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
  - Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
  - List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.
- ☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.
- ☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:
- ☐ is within the Zone II or Interim Wellhead Protection Area
  - ☐ is near or to other critical areas
  - ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
  - ☐ involves runoff from land uses with higher potential pollutant loads.
- ☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.
- ☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.



# Checklist for Stormwater Report

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## Checklist (continued)

### Standard 4: Water Quality (continued)

- ☒ The BMP is sized (and calculations provided) based on:
  - ☒ The ½" or 1" Water Quality Volume or
  - ☒ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.
- ☒ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.
- ☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

### Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

- ☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.
- ☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted **prior to** the discharge of stormwater to the post-construction stormwater BMPs.
- ☐ The NPDES Multi-Sector General Permit does **not** cover the land use.
- ☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.
- ☐ All exposure has been eliminated.
- ☐ All exposure has **not** been eliminated and all BMPs selected are on MassDEP LUHPPL list.
- ☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

### Standard 6: Critical Areas

- ☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.
- ☐ Critical areas and BMPs are identified in the Stormwater Report.



# Checklist for Stormwater Report

---

## Checklist (continued)

### Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

- ☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:
  - ☐ Limited Project
  - ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
  - ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
  - ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
  - ☐ Bike Path and/or Foot Path
  - ☒ Redevelopment Project
  - ☐ Redevelopment portion of mix of new and redevelopment.
- ☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.
- ☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

### Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
  - Construction Period Operation and Maintenance Plan;
  - Names of Persons or Entity Responsible for Plan Compliance;
  - Construction Period Pollution Prevention Measures;
  - Erosion and Sedimentation Control Plan Drawings;
  - Detail drawings and specifications for erosion control BMPs, including sizing calculations;
  - Vegetation Planning;
  - Site Development Plan;
  - Construction Sequencing Plan;
  - Sequencing of Erosion and Sedimentation Controls;
  - Operation and Maintenance of Erosion and Sedimentation Controls;
  - Inspection Schedule;
  - Maintenance Schedule;
  - Inspection and Maintenance Log Form.
- ☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.



# Checklist for Stormwater Report

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## Checklist (continued)

### Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

- ☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has **not** been included in the Stormwater Report but will be submitted **before** land disturbance begins.
- ☐ The project is **not** covered by a NPDES Construction General Permit.
- ☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.
- ☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

### Standard 9: Operation and Maintenance Plan

- ☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:
  - ☒ Name of the stormwater management system owners;
  - ☒ Party responsible for operation and maintenance;
  - ☒ Schedule for implementation of routine and non-routine maintenance tasks;
  - ☐ Plan showing the location of all stormwater BMPs maintenance access areas;
  - ☐ Description and delineation of public safety features;
  - ☐ Estimated operation and maintenance budget; and
  - ☒ Operation and Maintenance Log Form.
- ☐ The responsible party is **not** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:
  - ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
  - ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

### Standard 10: Prohibition of Illicit Discharges

- ☐ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;
- ☒ An Illicit Discharge Compliance Statement is attached;
- ☐ NO Illicit Discharge Compliance Statement is attached but will be submitted **prior to** the discharge of any stormwater to post-construction BMPs.

## **A P P E N D I X D**

### **Illicit Discharge Compliance Statement Supplemental BMP Calculations**

## Illicit Discharge Compliance Statement

I, Bradley C. McKenzie, P.E., hereby notify the Wellesley Conservation Commission that I have not witnessed, nor am aware of any existing illicit discharges at the site known as 148 Weston Road in Wellesley, Massachusetts. I also hereby certify that the development of said property as illustrated on the final plans entitled "148 Weston Road," prepared by McKenzie Engineering Group, Inc. dated February 28, 2020 and as revised and approved by the Wellesley Conservation Commission and maintenance thereof in accordance with the "Construction Phase Operations and Maintenance Plan" and "Long-Term Operations and Maintenance Plan" prepared by McKenzie Engineering Group, Inc. dated February 28, 2020 and as revised and approved by the Wellesley Conservation Commission will not create any new illicit discharges. There is no warranty implied regarding future illicit discharges that may occur as a result of improper construction or maintenance of the stormwater management system or unforeseen accidents.

**Name:** Bradley C. McKenzie, P.E.

**Company:** McKenzie Engineering Group, Inc.

**Title:** Owner's Representative

**Signature:**  \_\_\_\_\_

**Date:** 2-28-2020



Assinippi Office Park  
150 Longwater Drive, Suite 101  
Norwell, MA 02061

148 WESTON ROAD  
WELLESLEY, MA

2/28/2020

#### REQUIRED RECHARGE VOLUME (CF) "STATIC METHOD"

WATERSHED #	IMPERVIOUS AREA (SF)	TARGET DEPTH FACTOR (F) A SOIL	IMPERVIOUS AREA (SF)	TARGET DEPTH FACTOR (F) B SOIL	IMPERVIOUS AREA (SF)	TARGET DEPTH FACTOR (F) C SOIL	IMPERVIOUS AREA (SF)	TARGET DEPTH FACTOR (F) D SOIL	REQUIRED RECHARGE VOLUME (CF)
TOTAL SITE	40,892	0.60		0.35		0.25		0.10	2,045
		0.60		0.35		0.25		0.10	0
		0.60		0.35		0.25		0.10	0
							<b>TOTAL</b>		<b>2,045</b>

#### CAPTURE ADJUSTMENT

WATERSHED #	TOTAL IMPERVIOUS AREA (SF)	TOTAL IMPERVIOUS COLLECTED	% DIRECTED TOWARDS INFILTRATION SYSTEM	STANDARD NO. 3 > 65% CAPTURED<100%	CAPTURE ADJUSTMENT	ADJUSTED REQUIRED RECHARGE VOLUME (CF)
TOTAL SITE	40,892	40,081	98.02%	<b>CAPTURE ADJUSTMENT REQUIRED</b>	1.02	2,086

#### PROVIDED RECHARGE VOLUME (CF) BELOW LOWEST INVERT

REQUIRED RECHARGE VOLUME (CF)	POND	STORAGE VOLUME PROVIDED (CF)	NET STORAGE VOLUME PROVIDED (CF)
2,086	P-1	1,113	
	P-2	2,755	
	P-3	4,428	
	P-4	379	
	P-5	295	
<b>TOTAL</b>		<b>8,970</b>	<b>6,884</b>



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Norwell, MA 02061

2/28/2020

**148 WESTON ROAD  
WELLESLEY, MA**

**DRAWDOWN WITHIN 72 HOURS ANALYSIS**

POND	RAWLS RATE (IN/HR)	STORAGE VOLUME PROVIDED (CF)	BOTTOM AREA (FT <sup>2</sup> )	DRAWDOWN (HR)
P-1	8.27	1,113	1,087	1
P-2	8.27	2,755	1,531	3
P-3	2.41	4,428	2477	9
P-4	2.41	379	364	5
P-5	2.41	295	155	9

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148 WESTON ROAD  
WELLESLEY, MA

2/28/2020

P-1, P-2 & P-3 Require 44% TSS removal prior to infiltration use First Defense Units

**WATER QUALITY VOLUME ANALYSIS - PROPRIETARY STORMWATER TREATMENTS UNITS (FIRST DEFENSE UNITS)**

[illegible]

\*Use 4' Diameter First Defense Units

Figure 4: for First 1-inch Runoff, Table of  $q_u$  values for  $I_a/P$  Curve = 0.034, listed by  $t_c$ , for Type III Storm Distribution

$T_c$ (Hours)	$q_u$ (csm/in)	$T_c$ (Hours)	$q_u$ (csm/in)	$T_c$ (Hours)	$q_u$ (csm/in)
0.01	835	2.7	197	7.1	95
0.03	835	2.8	192	7.2	94
0.05	831	2.9	187	7.3	93
0.067	814	3	183	7.4	92
0.083	795	3.1	179	7.5	91
0.1	774	3.2	175	7.6	90
0.116	755	3.3	171	7.7	89
0.133	736	3.4	168	7.8	88
0.15	717	3.5	164	7.9	87
0.167	700	3.6	161	8	86
0.183	685	3.7	158	8.1	85
0.2	669	3.8	155	8.2	84
0.217	654	3.9	152	8.3	84
0.233	641	4	149	8.4	83
0.25	628	4.1	146	8.5	82
0.3	593	4.2	144	8.6	81
0.333	572	4.3	141	8.7	80
0.35	563	4.4	139	8.8	79
0.4	536	4.5	137	8.9	79
0.416	528	4.6	134	9	78
0.5	491	4.7	132	9.1	77
0.583	460	4.8	130	9.2	76
0.6	454	4.9	128	9.3	76
0.667	433	5	126	9.4	75
0.7	424	5.1	124	9.5	74
0.8	398	5.2	122	9.6	74
0.9	376	5.3	120	9.7	73
1	356	5.4	119	9.8	72
1.1	339	5.5	117	9.9	72
1.2	323	5.6	115	10	71
1.3	309	5.7	114		
1.4	296	5.8	112		
1.5	285	5.9	111		
1.6	274	6	109		
1.7	264	6.1	108		
1.8	255	6.2	106		
1.9	247	6.3	105		
2	239	6.4	104		
2.1	232	6.5	102		
2.2	225	6.6	101		
2.3	219	6.7	100		
2.4	213	6.8	99		
2.5	207	6.9	98		
2.6	202	7	96		



UNIVERSITY OF MASSACHUSETTS  
AT AMHERST

Water Resources Research Center  
Blaisdell House, UMass  
310 Hicks Way  
Amherst, MA 01003

Massachusetts Stormwater  
Evaluation Project

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[www.mastep.net](http://www.mastep.net)

## MASTEP Technology Review

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**Technology Name:** Hydro International First Defense

**Studies Reviewed:** Hydro International First Defense Testing Using Maine DEP Protocol Utilizing OK-110 Feed Sand. November 2004, testing conducted October 2004.

Hydro International First Defense Ok-110 Sand TSS (SSC) Removal Confirmation Test. Jeff Dennis, Maine DEP.

First Defense Performance Evaluation –Hydro International February 2011

**Date:** March 15, 2011

**Reviewer:** Sarah Titus, Updated by Jerry Schoen

**Rating:** 2

**Brief rationale for rating:** This rating is primarily based on the 2011 study report by Hydro International. This study was conducted by the manufacturer on a full scale 4' diameter model using a laboratory testing protocol that closely followed NJ DEP recommended protocol, which protocol is considered by MASTEP as the laboratory analog to TARP Tier II field protocol. The study was well run. 5 runs were conducted at flow rates ranging from 25% - 125% of the design treatment flow rate using OK-110 Silica sand.

**TARP Requirements Not Met\*:**

- OK-110 contains particle size distribution slightly larger than is recommended.
- Although witnessed by a 3<sup>rd</sup> party, this test was conducted by the manufacturer.
- Influent sediment concentration ranges from approximately 40 to approximately 200 mg/l. This is lower than required, but in one respect produces a more demanding test than the recommended 100-300 range, as lower concentrations are generally harder to treat effectively.

**Other notes:**

- A Quality Assurance Project Plan was prepared and appears to have been followed during the test.
- Scour tests were conducted according to recommended protocol. No scour was detected.
- Samples were analyzed for both SSC and TSS; removal rates were 71% and 70% respectively/

\* Criteria also based on NJDEP laboratory testing guidelines.

# First Defense®

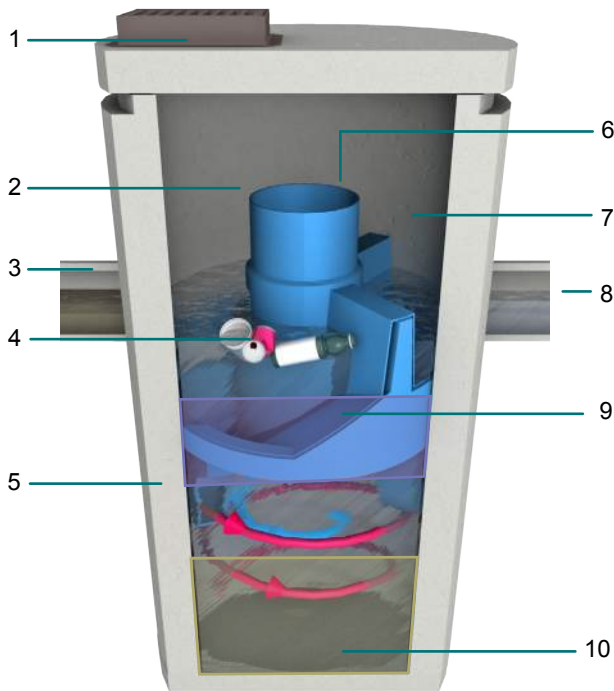
## A Simple Solution for your Trickiest Sites

### Product Profile

The First Defense® is an enhanced vortex separator that combines an effective stormwater treatment chamber with an integral peak flow bypass. It efficiently removes sediment total suspended solids (TSS), trash and hydrocarbons from stormwater runoff without washing out previously captured pollutants. The First Defense® is available in several model configurations to accommodate a wide range of pipe sizes, peak flows and depth constraints (**Table 1**, next page).

### Components

- |  |                               |
|--|-------------------------------|
| 1. Inlet Grate (optional)                  | 6. Internal Bypass            |
| 2. Inlet Chute                             | 7. Outlet Chute               |
| 3. Inlet Pipe (optional)                   | 8. Outlet Pipe                |
| 4. Floatables Draw Off Slot (not pictured) | 9. Oil and Floatables Storage |
| 5. Precast Vortex Chamber                  | 10. Sediment Storage Sump     |



**Fig.1** The First Defense® has internal components designed to efficiently capture pollutants and prevent washout at peak flows.

### Applications

- Stormwater treatment at the point of entry into the drainage line
- Sites constrained by space, topography or drainage profiles with limited slope and depth of cover
- Retrofit installations where stormwater treatment is placed on or tied into an existing storm drain line
- Pretreatment for filters, infiltration and storage

### Advantages

- Inlet options include surface grate or multiple inlet pipes
- Integral high capacity bypass conveys large peak flows without the need for “offline” arrangements using separate junction manholes
- Proven to prevent pollutant washout at up to 500% of its treatment flow
- Long flow path through the device ensures a long residence time within the treatment chamber, enhancing pollutant settling
- Delivered to site pre-assembled and ready for installation

### How it Works

The First Defense® has internal components designed to remove and retain gross debris, total suspended solids (TSS) and hydrocarbons (**Fig.1**).

Contaminated stormwater runoff enters the inlet chute from a surface grate and/or inlet pipe. The inlet chute introduces flow into the chamber tangentially to create a low energy vortex flow regime (**magenta arrow**) that directs sediment into the sump while oils, floating trash and debris rise to the surface.

Treated stormwater exits through a submerged outlet chute located opposite to the direction of the rotating flow (**blue arrow**). Enhanced vortex separation is provided by forcing the rotating flow within the vessel to follow the longest path possible rather than directly from inlet to outlet.

Higher flows bypass the treatment chamber to prevent turbulence and washout of captured pollutants. An integral bypass conveys infrequent peak flows directly to the outlet chute, eliminating the need for, and expense of, external bypass control structures. A floatables draw off slot functions to convey floatables into the treatment chamber prior to bypass.

# First Defense®

## Maintenance

The First Defense® needs minimal maintenance, but like all structural best management practices maintenance is necessary for the long-term protection of the environment.

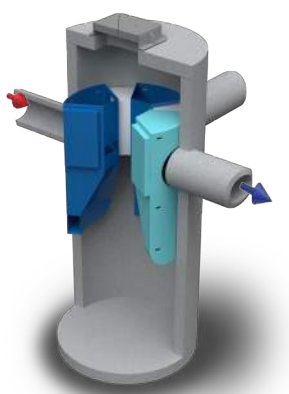
Sediments captured by the First Defense® are stored in the sump; floatable trash and hydrocarbons are stored on the surface of the standing water. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables (Fig.2).

More information can be found in the First Defense® Operation and Maintenance Manual, available at [hydro-int.com/firstdefense](http://hydro-int.com/firstdefense).

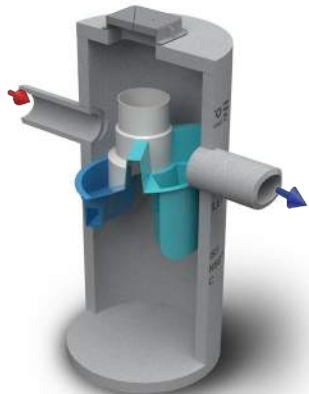
## First Defense® Sizing & Design

### Design Options for Inlet and Internal Bypass Arrangements

For maximum flexibility the First Defense® inlet and internal bypass arrangements are available in two configurations (Fig.3a & 3b). Model parameters and design criteria are shown in Table 1.



**Fig.3a** Inlet configurations for all models include options for inlet grates and multiple inlet pipes.



**Fig.3b** First Defense®-HC with higher capacity internal bypass and larger maximum pipe diameter.



**Fig.2** Maintenance is performed with a vector truck.

### Free Stormwater Separator Sizing Calculator for Engineers



This simple online tool will recommend the best separator, model size and online/offline arrangement based on site-specific data entered by the user.

Go to [hydro-int.com/sizing](http://hydro-int.com/sizing) to access the tool.

**Table 1.** First Defense® Models and Design Criteria.

First Defense® Model Number	Diameter	Typical Flow Rates for TSS Treatment		Peak Online Flow Rate	Maximum Pipe Diameter <sup>1</sup>	Oil Storage Capacity	Typical Sediment Storage Capacity <sup>2</sup>	Minimum Distance from Outlet Invert to Top of Rim <sup>3</sup>	Standard Distance from Outlet Invert to Sump Floor
		106µm	230µm						
	(ft / m)	(cfs / L/s)	(cfs / L/s)	(cfs / L/s)	(in / mm)	(gal / L)	(yd³ / m³)	(ft / m)	(ft / m)
FD-4	4 / 1.2	0.7 / 20	1.2 / 34	6 / 170	18 / 450	180 / 681	0.7 / 0.5	3.1 / 1.1	4.97 / 1.5
FD-4HC				18 / 510	24 / 600	191 / 723		2.3 - 3.9 / 0.7 - 1.2	
FD-6	6 / 1.8	2.2 / 63	3.8 / 108	18 / 510	24 / 600	420 / 1,590	1.6 / 1.2	4.0 / 1.2	5.97 / 1.8
FD-6HC				32 / 906	30 / 750	496 / 1,878		3.0 - 5.1 / 0.9 - 1.6	

<sup>1</sup>Contact Hydro International when larger pipe sizes are required.

<sup>2</sup>Contact Hydro International when custom sediment storage capacity is required.

<sup>3</sup>The minimum distance for the 4HC and 6HC models depends on pipe diameter.



Assinippi Office Park  
150 Longwater Drive, Suite 101  
Norwell, MA 02061

# Standard 4: Pretreatment: Subsurface Chambers P-1

**NAME:** 148 Weston Road  
Wellesley, MA  
**CLIENT:** Wellesley park, LLC  
**COUNTY:** Norfolk

**Proj. No.:** 217-177  
**Date:** 2/28/2020  
**Revised:**  
**Computed by:** SBS  
**Checked by:** BCM

TSS Removal Calculation	B	C	D	E	F
	BMP	TSS Removal Rate	Starting TSS Load (*F)	Amount Removed (C*D)	Remaining Load (D-E)
		0.00	1.00	0.00	1.00
		0.00	1.00	0.00	1.00
	First Defense-Recommended TSS Removal Per Mass STEP	0.70	1.00	0.70	0.30
		0.00	0.30	0.00	0.30
		0.00	0.30	0.00	0.30
Total TSS Removal =					70%

\*Equals remaining load from previous BMP (E)  
which enters the BMP



Assinippi Office Park  
150 Longwater Drive, Suite 101  
Norwell, MA 02061

**Standard 4: Total Suspended Solids Calculation: Subsurface Chambers P-1**

**NAME:** 148 Weston Road  
Wellesley, MA  
**CLIENT:** Wellesley park, LLC  
**COUNTY:** Norfolk

**Proj. No.:** 217-177  
**Date:** 2/28/2020  
**Revised:**  
**Computed by:** SBS  
**Checked by:** BCM

TSS Removal Calculation	B	C	D	E	F
	BMP	TSS Removal Rate	Starting TSS Load (*F)	Amount Removed (C*D)	Remaining Load (D-E)
		0.00	1.00	0.00	1.00
		0.00	1.00	1.00	1.00
	First Defense-Recommended TSS Removal Per Mass STEP	0.70	1.00	0.70	0.30
	Subsurface Infiltration Structure	0.80	0.30	0.24	0.06
		0.00	0.06	0.00	0.06

**Total TSS Removal =**

**94%**

\*Equals remaining load from previous BMP (E)  
which enters the BMP



Assinippi Office Park  
150 Longwater Drive, Suite 101  
Norwell, MA 02061

**Standard 4: Pretreatment: Subsurface Chambers P-2**

**NAME:** 148 Weston Road  
Wellesley, MA  
**CLIENT:** Wellesley park, LLC  
**COUNTY:** Norfolk

**Proj. No.:** 217-177  
**Date:** 2/28/2020  
**Revised:**  
**Computed by:** SBS  
**Checked by:** BCM

TSS Removal Calculation	B	C	D	E	F
	BMP	TSS Removal Rate	Starting TSS Load (*F)	Amount Removed (C*D)	Remaining Load (D-E)
		0.00	1.00	0.00	1.00
	Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
	First Defense-Recommended TSS Removal Per Mass STEP	0.70	0.75	0.53	0.23
		0.00	0.23	0.00	0.23
		0.00	0.23	0.00	0.23
Total TSS Removal =					78%

\*Equals remaining load from previous BMP (E)  
which enters the BMP



Assinippi Office Park  
150 Longwater Drive, Suite 101  
Norwell, MA 02061

# Standard 4: Total Suspended Solids Calculation: P-2

**NAME:** 148 Weston Road  
Wellesley, MA  
**CLIENT:** Wellesley park, LLC  
**COUNTY:** Norfolk

**Proj. No.:** 217-177  
**Date:** 2/28/2020  
**Revised:**  
**Computed by:** SBS  
**Checked by:** BCM

TSS Removal Calculation	B	C	D	E	F
	BMP	TSS Removal Rate	Starting TSS Load (*F)	Amount Removed (C*D)	Remaining Load (D-E)
	Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
	First Defense-Recommended TSS Removal Per Mass STEP	0.70	0.75	0.53	0.23
	Subsurface Infiltration Structure	0.80	0.23	0.18	0.05
		0.00	0.05	0.00	0.05
		0.00	0.05	0.00	0.05

**Total TSS Removal =**

**96%**

\*Equals remaining load from previous BMP (E)  
which enters the BMP



Assinippi Office Park  
150 Longwater Drive, Suite 101  
Norwell, MA 02061

**Standard 4: Pretreatment: Subsurface Chambers P-3**

**NAME:** 148 Weston Road  
Wellesley, MA  
**CLIENT:** Wellesley park, LLC  
**COUNTY:** Norfolk

**Proj. No.:** 217-177  
**Date:** 2/28/2020  
**Revised:**  
**Computed by:** SBS  
**Checked by:** BCM

TSS Removal Calculation	B	C	D	E	F
	BMP	TSS Removal Rate	Starting TSS Load (*F)	Amount Removed (C*D)	Remaining Load (D-E)
		0.00	1.00	0.00	1.00
	Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
	First Defense-Recommended TSS Removal Per Mass STEP	0.70	0.75	0.53	0.23
		0.00	0.23	0.00	0.23
		0.00	0.23	0.00	0.23
Total TSS Removal =					78%

\*Equals remaining load from previous BMP (E)  
which enters the BMP



Assinippi Office Park  
150 Longwater Drive, Suite 101  
Norwell, MA 02061

# Standard 4: Total Suspended Solids Calculation: P-3

**NAME:** 148 Weston Road  
Wellesley, MA  
**CLIENT:** Wellesley park, LLC  
**COUNTY:** Norfolk

**Proj. No.:** 217-177  
**Date:** 2/28/2020  
**Revised:**  
**Computed by:** SBS  
**Checked by:** BCM

TSS Removal Calculation	B	C	D	E	F
	BMP	TSS Removal Rate	Starting TSS Load (*F)	Amount Removed (C*D)	Remaining Load (D-E)
	Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
	First Defense-Recommended TSS Removal Per Mass STEP	0.70	0.75	0.53	0.23
	Subsurface Infiltration Structure	0.80	0.23	0.18	0.05
		0.00	0.05	0.00	0.05
		0.00	0.05	0.00	0.05

**Total TSS Removal =**

**96%**

\*Equals remaining load from previous BMP (E)  
which enters the BMP

## **A P P E N D I X E**

### **Operation and Maintenance Plans**

**Construction Phase Pollution Prevention and Erosion and  
Sedimentation Control Plan  
(Best Management Practices  
Operation and Maintenance Plan)**

*for*

**140-148 Weston Road  
Wellesley, Massachusetts**

***Submitted to:*  
Town of Wellesley**

***Prepared for:*  
Wellesley Park, LLC  
49 Coolidge Street  
Brookline, Massachusetts 02466**

***Prepared by:***



**Professional Civil Engineering • Project Management • Land Planning  
150 Longwater Drive, Suite 101, Norwell, Massachusetts 02061  
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**February 28, 2020**

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**Construction Phase Pollution Prevention &  
Erosion and Sedimentation Control Plan**

Erosion and Sedimentation will be controlled at the site by utilizing Structural Practices, Stabilization Practices, and Dust Control. These practices correspond with plans entitled "148 Weston Road, Wellesley, Massachusetts," dated February 28, 2020, prepared by McKenzie Engineering Group, Inc., hereinafter referred to as the Site Plans.

**Property Owner:**

Wellesley Park, LLC  
49 Coolidge Street  
Brookline, MA 02446

**Developer Contact Information:**

Wellesley Park, LLC  
49 Coolidge Street  
Brookline, MA 02446

**Town of Wellesley Contact Information:**

Wellesley Department of Public Works – Engineering Division  
David J. Hickey, Jr., P.E., Town Engineer  
20 Municipal Way  
Wellesley, MA 02481  
Phone: 781-237-0047  
Fax: 781-237-0047

Wellesley Protection Committee  
Julie Meyer, Wetlands Administrator  
525 Washington Street  
Wellesley, MA 02482  
Phone: 781-431-1019, ext. 2292

Wellesley Building Department  
Michael T. Grant, Inspector of Buildings  
525 Washington Street  
Wellesley, MA 02482  
Phone: 781-431-1019

Wellesley Zoning Board of Appeals  
Lenore Mahoney, Executive Secretary  
525 Washington Street  
Wellesley, MA 02482  
Phone: 781-431-1019, ext. 2208

**Narrative:**

**Project Description:**

The project proponent Wellesley Park, LLC, proposes to redevelop a 1.28-acre parcel of land located at 140-148 Weston Road in Wellesley, Massachusetts. The proposed redevelopment will consist of 26 multi-family residential units. The proposed development will involve the construction of a three (3) story plus one (1) basement level

parking building, sidewalks, roof-top courtyard, retaining walls, access drive, stormwater management systems, utilities and other related infrastructure.

The project is comprised of three (3) parcels which is shown as Parcel ID 149-1, 149-3, and 149-4 on the Town of Wellesley Assessor's Map. The site is bounded by Weston Road to the northeast, developed residential property to the southeast and municipal property owned by the Town of Wellesley to the north and west as shown on Figure 1 - USGS Locus Map.

The project will access the existing utility infrastructure located on Weston Road, including sanitary sewer, water, gas, electric, telephone, and cable television. The stormwater management system will be designed to fully comply with all standards of the Department of Environment Protection's Stormwater Management Regulations and will utilize an on-site subsurface infiltration system for stormwater storage and treatment.

### **Site Description:**

The property is located within the General Residence Zoning District and the Residential Incentive Overlay District. The majority of the 1.28 acre-parcel is vacant with one (1) single family home and bituminous driveway and associated landscaping located on Parcel 149-3.

The existing topography generally ranges in elevation from approximately 159 ft. (Wellesley Vertical Datum) in the northeast portion of the site to an elevation of approximately 142 ft. (Wellesley Vertical Datum) in the southeast portion of the site. The parcel slopes from the northeast and southeast property lines, towards a depression in the middle of the site.

Review of available environmental databases such as MassGIS reveals that the site is not located within a mapped Natural Heritage Endangered Species Area, FEMA Flood Insurance Rate Map Panel No. 25021C0016E (refer to Figure 2 - FEMA Flood Map), or a Contributing Watershed to Outstanding Resource Water (ORW).

The site is located within Wellesley College's Zone II Wellhead Protection Area, (refer to Figure 4 - Wellhead Protection Area Map) and the Town of Wellesley's Water Supply Protection District, (refer to Figure 5 - Wellesley Zoning Map).

The existing watershed analyzed in this report is comprised of approximately 3.158 acres which includes the subject parcel and a portion of offsite tributary areas to the northwest. The watershed consists of one (1) sub-catchment area (1S) and one (1) Design Point (DP-1). Refer to the Pre-Development Watershed Plan WS-1 in Appendix A for a delineation of drainage subcatchments for the pre-development design condition.

### **Soils:**

The Natural Resources Conservation Service (NRCS) has identified the soil on the site as 254B, Merrimac Fine Sandy Loam, 3 to 8% slopes with hydrologic soil group (HSG) A, and 630C, Charlton-Hollis-Urban land complex, 3 to 15% slopes with hydrologic soil group (HSG) A. Refer to Figure 3 - NRCS Soils Map. Soil testing conducted by McKenzie Engineering Group, Inc. (MEG) on January 31, 2018 identified the soils to be sand, sandy loam and loamy sand. Refer to the soil logs in Appendix C.

## **Erosion and Sedimentation Control Practices:**

### **Structural Practices:**

- 1) **Sediment Silt Sock Barrier Controls** – A sediment silt sock barrier will be constructed along downward slopes at the limit of work in locations shown on the plans. This control will be installed prior to major soil disturbance on the site. The sediment silt sock should be installed as shown on the Erosion Control Detail Plan.

#### **Sediment Silt Sock Design/Installation Requirements**

- a) Locate the silt sock where identified on the plans.
- b) The silt sock line should be nearly level through most of its length to impound a broad, temporary pool. The last 10 to 20 feet at each end of the silt sock should be swung slightly uphill (approximately 0.5 feet in elevation) to provide storage capacity.
- c) The silt sock shall be staked every 8 linear feet with 1-inch by 1-inch stakes.
- d) Sediment silt socks should be removed when they have served their useful purpose, but not before the upslope area has been permanently stabilized through one growing season. Retained sediment must be removed and properly disposed of, or mulched and seeded.

#### **Sediment Silt Sock Inspection/Maintenance**

- a) Silt socks should be inspected immediately after each rainfall event of 1-inch or greater, and at least daily during prolonged rainfall. Inspect the depth of sediment, fabric tears, and to see that the stakes are firmly in the ground. Repair or replace as necessary.
- b) Remove sediment deposits promptly after storm events to provide adequate storage volume for the next rain and to reduce pressure on the sock. Sediment will be removed from behind the silt sock when it becomes about ½ foot deep at the silt sock. Take care to avoid undermining the sock during cleanout.
- c) If the fabric tears, decomposes, or in any way becomes ineffective, replace it immediately.

Remove staking only after the contributing drainage areas have been properly stabilized. Sediment deposits and silt sock materials remaining after stakes have been removed should be graded to conform to the existing topography and vegetated.

- 2) **Stabilized Construction Entrance** – A stabilized construction entrances will be placed at the proposed entrances on Washington Street. The stabilized construction entrances will be installed immediately after the clearing and grubbing of the site entrance and associated roadway cut/fill to maintain access to the site are completed. The stormwater runoff from the entrance will be diverted to temporary sedimentation basins alongside the proposed driveway. The construction entrance will keep mud and sediment from being tracked off the construction site onto Washington Street by vehicles leaving the site. The stabilized construction entrances shall be constructed as shown on the Erosion Control Detail Plan.

#### Construction Entrance Design/Construction Requirements \*

- a) Grade foundation for positive drainage towards the temporary sedimentation basin along the side of the roadway.
- b) Stone for a stabilized construction entrance shall consist of 1 to 3-inch stone placed on a stable foundation.
- c) Pad dimensions: The minimum length of the gravel pad should be 50 feet. The pad should extend the full width of the proposed roadway, or wide enough so that the largest construction vehicle will fit in the entrance with room to spare; whichever is greater. If a large amount of traffic is expected at the entrance, then the stabilized construction entrance should be wide enough to fit two vehicles across with room to spare.
- d) A geotextile filter fabric shall be placed between the stone fill and the earth surface below the pad to reduce the migration of soil particles from the underlying soil into the stone and vice versa. The filter fabric should be Amoco woven polypropylene 1198 or equivalent.
- e) Washing: If the site conditions are such that the majority of mud is not removed from the vehicle tires by the gravel pad, then the tires should be washed before the vehicle enters the street. The wash area should be a level area with 3-inch washed stone minimum, or a commercial rack.
- f) Water employed in the washing process shall be directed to a sediment trap or approved sediment-trapping device prior to discharge to a temporary sedimentation basin along side the site entrance drive. Sediment should be prevented from entering any watercourses.

#### Construction Entrance Inspection/Maintenance \*

- a) The entrance should be maintained in a condition that will prevent tracking or flowing of sediment onto Washington Street. This may require periodic topdressing with additional stone
- b) The construction entrance and sediment disposal area shall be inspected weekly and after heavy rains or heavy use.
- c) Mud and sediment tracked or washed onto public road shall be immediately removed by sweeping.
- d) Once mud and soil particles clog the voids in the gravel and the effectiveness of the gravel pad is no longer satisfactory, the pad must be topdressed with new stone. Replacement of the entire pad may be necessary when the pad becomes completely clogged.

- e) If washing facilities are used, the sediment traps should be cleaned out as often as necessary to assure that adequate trapping efficiency and storage volume is available.
  - f) The pad shall be reshaped as needed for drainage and runoff control.
  - g) Broken road pavement on Washington Street shall be repaired immediately.
  - h) All temporary erosion and sediment control measures shall be removed within 30 days after final site stabilization is achieved or after the temporary practices are no longer needed. Trapped sediment shall be removed or stabilized on site. Disturbed soil areas resulting from removal shall be permanently stabilized.
- 3) **Inlet Protection** – Inlet Protection will be utilized around the catch basin grates. The inlet protection will allow the storm drain inlets to be used before final stabilization. This structural practice will allow early use of the drainage system if the detention basin is already stabilized. Siltsack or equivalent will be utilized for the inlet protection. Siltsack is manufactured by ACF Environmental. The telephone number is 1-800-437-6746. Regular flow siltsack will be utilized, and if it does not allow enough storm water flow, hi-flow siltsack will be utilized.

**Silt Sack (or equivalent) Inlet Protection Inspection/Maintenance Requirements \***

- a) All trapping devices and the structures they protect should be inspected after every rain storm and repairs made as necessary.
- b) Sediment should be removed from the trapping devices after the sediment has reached a maximum depth of one-half the depth of the trap.
- c) Sediment should be disposed of in a suitable area and protected from erosion by either structural or vegetative means. Sediment removed shall be disposed of in accordance with all applicable local, state, and federal regulations.
- d) The silt sack must be replaced if it is ripped or torn in any way.
- e) Temporary traps should be removed and the area repaired as soon as the contributing drainage area to the inlet has been completely stabilized.

**Stabilization Practices:**

Stabilization measures shall be implemented as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased, with the following exceptions.

- Where the initiation of stabilization measures by the 14<sup>th</sup> day after construction activity temporary or permanently cease is precluded by snow cover, stabilization measures shall be initiated as soon as practicable.
- Where construction activity will resume on a portion of the site within 21 days from when activities ceased, (e.g. the total time period that

construction activity is temporarily ceased is less than 21 days) then stabilization measures do not have to be initiated on that portion of the site by the 14<sup>th</sup> day after construction activity temporarily ceased.

- 1) **Temporary Seeding** – Temporary seeding will allow a short-term vegetative cover on disturbed site areas that may be in danger of erosion. Temporary seeding will be done at stock piles and disturbed portions of the site where construction activity will temporarily cease for at least 21 days. The temporary seedings will stabilize cleared and unvegetated areas that will not be brought into final grade for several weeks or months.

**Temporary Seeding Planting Procedures \***

- a) Planting should preferably be done between April 1<sup>st</sup> and June 30<sup>th</sup>, and September 1<sup>st</sup> through September 31<sup>st</sup>. If planting is done in the months of July and August, irrigation may be required. If planting is done between October 1<sup>st</sup> and March 31<sup>st</sup>, mulching should be applied immediately after planting. If seeding is done during the summer months, irrigation of some sort will probably be necessary.
- b) Before seeding, install structural practice controls. Utilize Amoco supergro or equivalent.
- c) The seedbed should be firm with a fairly fine surface. Perform all cultural operations across or at right angles to the slope. A minimum of 2 to 4-inches of tilled topsoil is required. The topsoil must have a sandy loam to silt loam texture with 15% to 20% organic content.
- d) Apply uniformly 2 tons of ground limestone per acre (100 lbs. Per 1,000 sq.ft.) or according to soil test. Apply uniformly 10-10-10 analysis fertilizer at the rate of 400 lbs. per acre (14 lbs. per 1,000 sq.ft.) or as indicated by soil test. Forty percent of the nitrogen should be in organic form. Work in lime and fertilizer to a depth of 4-inches using any suitable equipment.
- e) Select the appropriate seed species for temporary cover from the following table.

Species	Seeding Rate (lbs/1,000 sq.ft.)	Seeding Rate (lbs/acre)	Recommended Seeding Dates	Seed Cover required
Annual Ryegrass	1	40	April 1 <sup>st</sup> to June 1 <sup>st</sup> August 15 <sup>th</sup> to Sept. 15 <sup>th</sup>	¼ inch
Foxtail Millet	0.7	30	May 1 <sup>st</sup> to June 30 <sup>th</sup>	½ to ¾ inch
Oats	2	80	April 1 <sup>st</sup> to July 1 <sup>st</sup> August 15 <sup>th</sup> to Sept. 15 <sup>th</sup>	1 to 1-½ inch
Winter Rye	3	120	August 15 <sup>th</sup> to Oct. 15 <sup>th</sup>	1 to 1-½ inch

Apply the seed uniformly by hydroseeding, broadcasting, or by hand.

- f) Use an effective mulch, such as clean grain straw; tacked and/or tied with netting to protect seedbed and encourage plant growth.

### Temporary Seeding Inspection/Maintenance \*

- a) Inspect within 6 weeks of planting to see if stands are adequate. Check for damage within 24 hours of the end to a heavy rainfall, defined as a 2-year storm event (i.e., 3.2 inches of rainfall within a twenty-four-hour period). Stands should be uniform and dense. Fertilize, reseed, and mulch damaged and sparse areas immediately. Tack or tie down mulch as necessary.
  - b) Seeds should be supplied with adequate moisture. Furnish water as needed, especially in abnormally hot or dry weather. Water application rates should be controlled to prevent runoff.
- 2) **Geotextiles** - Geotextiles such as jute netting will be used in combination with other practices such as mulching to stabilize slopes. The following geotextile materials or equivalent are to be utilized for structural and nonstructural controls as shown in the following table.

Practice	Manufacturer	Product	Remarks
Sediment Fence	Amoco	Woven polypropylene 1198 or equivalent	0.425 mm opening
Construction Entrance	Amoco	Woven polypropylene 2002 or equivalent	0.300 mm opening
Outlet Protection	Amoco	Nonwoven polypropylene 4551 or equivalent	0.150 mm opening

Amoco may be reached at (800) 445-7732

### Geotextile Installation

- a) Netting and matting require firm, continuous contact between the materials and the soil. If there is no contact, the material will not hold the soil and erosion will occur underneath the material.

### Geotextile Inspection/Maintenance \*

- a) In the field, regular inspections should be made to check for cracks, tears, or breaches in the fabric. The appropriate repairs should be made.
- 3) **Mulching and Netting** – Mulching will provide immediate protection to exposed soils during the period of short construction delays, or over winter months through the application of plant residues, or other suitable materials, to exposed soil areas. In areas, which have been seeded either for temporary or permanent cover, mulching should immediately follow seeding. On steep slopes, mulch must be supplemented with netting. The preferred mulching material is straw.

### Mulch (Hay or Straw) Materials and Installation

- a) Straw has been found to be one of the most effective organic mulch materials. The specifications for straw are described below, but other material may be appropriate. The straw should be air-dried; free of undesirable seeds & coarse materials. The application rate per 1,000 sq.ft. is 90-100 lbs. (2-3 bales) and the application rate per acre is 2 tons (100-120 bales). The application should cover about 90% of the surface. The use of straw mulch is appropriate where mulch is

maintained for more than three months. Straw mulch is subject to wind blowing unless anchored, is the most commonly used mulching material, and has the best microenvironment for germinating seeds.

#### Mulch Maintenance \*

- a) Inspect after rainstorms to check for movement of mulch or erosion. If washout, breakage, or erosion occurs, repair surface, reseed, remulch, and install new netting.
  - b) Straw or grass mulches that blow or wash away should be repaired promptly.
  - c) If plastic netting is used to anchor mulch, care should be taken during initial mowings to keep the mower height high. Otherwise, the netting can wrap up on the mower blade shafts. After a period of time, the netting degrades and becomes less of a problem.
  - d) Continue inspections until vegetation is well established.
- 4) **Land Grading** – Grading on fill slopes, cut slopes, and stockpile areas will be done with full siltation controls in place.

#### Land Grading Design/Installation Requirements

- a) Areas to be graded should be cleared and grubbed of all timber, logs, brush, rubbish, and vegetated matter that will interfere with the grading operation. All brush, tree limbs, tree trunk and stump disposal shall take place off site and within 30 days of cutting. All disposal shall be in accordance with federal, state and local regulations. Any temporary stockpiling of brush, tree limbs, tree trunks or stumps shall be surrounded with an erosion control barrier. Topsoil should be stripped and stockpiled for use on critical disturbed areas for establishment of vegetation. Cut slopes to be topsoiled should be thoroughly scarified to a minimum depth of 3-inches prior to placement of topsoil.
- b) Fill materials should be generally free of brush, rubbish, rocks, and stumps. Frozen materials or soft and easily compressible materials should not be used in fills intended to support buildings, parking lots, roads, conduits, or other structures.
- c) Earth fill intended to support structural measures should be compacted to a minimum of 90 percent of Standard Proctor Test density with proper moisture control, or as otherwise specified by the engineer responsible for the design. Compaction of other fills should be to the density required to control sloughing, erosion or excessive moisture content. Maximum thickness of fill layers prior to compaction should not exceed 9 inches.
- d) The uppermost one foot of fill slopes should be compacted to at least 85 percent of the maximum unit weight (based on the modified AASHTO compaction test). This is usually accomplished by running heavy equipment over the fill.

- e) Fill should consist of material from borrow areas and excess cut will be stockpiled in areas shown on the Site Plans. All disturbed areas should be free draining, left with a neat and finished appearance, and should be protected from erosion.

#### Land Grading Stabilization Inspection/Maintenance \*

- a) All slopes should be checked periodically to see that vegetation is in good condition. Any rills or damage from erosion and animal burrowing should be repaired immediately to avoid further damage.
  - b) If seeps develop on the slopes, the area should be evaluated to determine if the seep will cause an unstable condition. Subsurface drains or a gravel mulch may be required to solve seep problems. However, no seeps are anticipated.
  - c) Areas requiring revegetation should be repaired immediately. Slopes should be limed and fertilized as necessary to keep vegetation healthy. Control undesirable vegetation such as weeds and woody growth to avoid bank stability problems in the future.
- 5) **Topsoiling \*** – Topsoiling will help establish vegetation on all disturbed areas throughout the site during the seeding process. The soil texture of the topsoil to be used will be a sandy loam to a silt loam texture with 15% to 20% organic content.

#### Topsoiling Placement

- a) Topsoil should not be placed while in a frozen or muddy condition, when the subgrade is excessively wet, or when conditions exist that may otherwise be detrimental to proper grading or proposed seeding.
  - b) Do not place topsoil on slopes steeper than 2.5:1, as it will tend to erode.
  - c) If topsoil and subsoil are not properly bonded, water will not infiltrate the soil profile evenly and it will be difficult to establish vegetation. The best method is to actually work the topsoil into the layer below for a depth of at least 6 inches.
- 6) **Permanent Seeding** – Permanent Seeding should be done immediately after the final design grades are achieved. Native species of plants should be used to establish perennial vegetative cover on disturbed areas. The revegetation should be done early enough in the fall so that a good cover is established before cold weather comes and growth stops until the spring. A good cover is defined as vegetation covering 75 percent or more of the ground surface.

#### Permanent Seeding Seedbed Preparation

- a) In infertile or coarse-textured subsoil, it is best to stockpile topsoil and respread it over the finished slope at a minimum 2 to 6-inch depth and roll it to provide a firm seedbed.
- b) The topsoil must have a sandy loam to silt loam texture with 15% to 20% organic content. If construction fill operations have left soil exposed with a loose, rough, or irregular surface, smooth with blade and roll.

- c) Loosen the soil to a depth of 3-5 inches with suitable agricultural or construction equipment.
- d) Areas not to receive topsoil shall be treated to firm the seedbed after incorporation of the lime and fertilizer so that it is depressed no more than ½ - 1 inch when stepped on with a shoe. Areas to receive topsoil shall not be firmed until after topsoiling and lime and fertilizer is applied and incorporated, at which time it shall be treated to firm the seedbed as described above.

#### Permanent Seeding Grass Selection/Application

- a) Select an appropriate cool or warm season grass based on site conditions and seeding date. Apply the seed uniformly by hydroseeding, broadcasting, or by hand. Uniform seed distribution is essential. On steep slopes, hydroseeding may be the most effective seeding method. Surface roughening is particularly important when preparing slopes for hydroseeding.
- b) Lime and fertilize. Organic fertilizer shall be utilized in areas within the 100 foot buffer zone to a wetland resource area.
- c) Mulch the seedlings with straw applied at the rate of ½ tons per acre. Anchor the mulch with erosion control netting or fabric on sloping areas. Amoco supergro or equivalent should be utilized.

#### Permanent Seeding Inspection/Maintenance \*

- a) Frequently inspect seeded areas for failure and make necessary repairs and reseed immediately. Conduct or follow-up survey after one year and replace failed plants where necessary.
- b) If vegetative cover is inadequate to prevent rill erosion, overseed and fertilize in accordance with soil test results.
- c) If a stand has less than 40% cover, reevaluate choice of plant materials and quantities of lime and fertilizer. Re-establish the stand following seedbed preparation and seeding recommendations, omitting lime and fertilizer in the absence of soil test results. If the season prevents resowing, mulch or jute netting is an effective temporary cover.
- d) Seeded areas should be fertilized during the second growing season. Lime and fertilize thereafter at periodic intervals, as needed. Organic fertilizer shall be utilized in areas within the 100-foot buffer zone to a wetland resource area.

#### **Dust Control \*:**

Dust control will be utilized throughout the entire construction process of the site. For example, keeping disturbed surfaces moist during windy periods will be an effective control measure, especially for construction haul roads. The use of dust control will prevent the movement of soil to offsite areas. However, care must be taken to not create runoff from excessive use of water to control dust. The following are methods of Dust Control that may be used on-site:

- Vegetative Cover – The most practical method for disturbed areas not subject to traffic.
- Calcium Chloride – Calcium chloride may be applied by mechanical spreader as loose, dry granules or flakes at a rate that keeps the surface moist but not so high as to cause water pollution or plant damage.
- Sprinkling – The site may be sprinkled until the surface is wet. Sprinkling will be effective for dust control on haul roads and other traffic routes.
- Stone – Stone will be used to stabilize construction roads; will also be effective for dust control.

### **Non-Stormwater Discharges:**

During construction activities at the site, some water from the site will be suitable for discharge to the detention areas and/or temporary sediment basin areas. Non-stormwater discharges will be directed to recharge groundwater and to replenish wetland resource areas.

The construction de-watering and all non-stormwater discharges will be directed into a sediment dirt bag (or equivalent inlet protection) or a sediment basin. Sediment material removed shall be disposed of in accordance with all applicable local, state, and federal regulations.

The developer and site general contractor will comply with the E.P.A.'s Final General Permit for Construction De-watering Discharges.

### **Soil Stockpiling \*:**

Topsoil and subsoil from the driveway and parking area grading will be stockpiled in locations shown on the plans.

### **Stockpile Material Construction Procedure**

- 1) Topsoil and subsoil that are stripped will be stockpiled for later distribution on disturbed areas.
- 2) The stockpiles will be located as shown on the plans. These locations will allow them to not interfere with work on the site.
- 3) Seed the stockpiles with a temporary erosion control mix if the stockpile is to remain undisturbed for more than 30 days. The stockpiles must be stable and the side slopes should not exceed 2:1.
- 4) Sediment silt sock or hay bale barrier erosion control measure should be placed surrounding each stockpile.
- 5) As needed, the stockpiled topsoil and subsoil are redistributed throughout the site.

### **Pollution Prevention:**

### **Fueling and Maintenance of Equipment or Vehicles**

**Refueling/maintenance Rules** – The site supervisor shall produce a written document received by all subcontractors and employees that delineates their responsibilities on

site. This document shall include language that shall permit the maintenance of vehicles only in designated locations on the job site. In the event of mechanical failure of a vehicle, the vehicle shall be moved to the designated maintenance area on the site to perform maintenance. The site supervisor shall document receipt of these instructions by obtaining the signatures of subcontractors and individuals that may enter the site and the date in which they were notified of their responsibilities. Refueling for vehicles or equipment shall occur either within the designated washout area or shall utilize temporary drip protection measures at the location of fueling. The site supervisor or their representative shall be present at the time of any fueling procedure. The site supervisor shall have a fuel spill plan and measures on site to initiate containment and clean-up in the event a fuel spill occurs.

1. Fueling operations shall take place in designated area(s) as shown on site maps. Provide temporary drip protection during fueling operations which take place outside of designated area(s). Materials necessary to address a spill shall be made readily available in a location known to the site supervisor or his/her designee.
2. Fueling operation procedures shall be in effect throughout the project duration.

#### Maintenance Requirements

1. All emergency response equipment listed in the Emergency Response Equipment Inventory shall be made readily available and kept in a designated location known to the site supervisor or his/her designee. All such materials shall be replenished as necessary to the listed amounts.

#### **Washing of Equipment and Vehicles**

**Vehicle Washing Rules** - The site supervisor shall produce a written document received by all subcontractors and employees that delineates their responsibilities on site. The site supervisor shall document receipt of these instructions by obtaining the signatures of subcontractors and individuals that may enter the site and the date in which they were notified of their responsibilities. This document shall include language that shall not permit vehicle washing on the job site. Concrete trucks shall be exempt from this rule. Concrete truck cleaning shall be confined within the work area and conducted in a manner to prevent water drainage beyond the specified area of work.

Concrete truck washout shall be conducted in designated areas and shall not be discharged in areas which would allow wash water to leave the site or enter protected areas.

#### Maintenance Requirements

1. The site supervisor shall maintain a log of individuals receiving these instructions.

#### **Storage, Handling, and Disposal of Construction Products, Materials, and Wastes**

**Building Products** - Building products are not anticipated during this phase of construction.

#### **Pesticides, Herbicides, Insecticides, Fertilizers, and Landscape Materials**

The use of pesticides and herbicides is not currently anticipated for this site. Fertilizers and landscape materials will be used to stabilize slopes and other disturbed areas.

1. Store all fertilizers and landscape materials in designated locations. Store all weather sensitive materials in closed containers in accordance with manufacturer's recommendations.

#### Maintenance Requirements

1. The site supervisor shall regularly inspect the designated storage areas as well as any portions of the site under construction to ensure that all materials are properly stored. The site supervisor shall immediately address any issues and instruct personnel to secure and properly store all materials.

#### **Diesel Fuel, Oil, Hydraulic Fluids, Other Petroleum Products, and Other Chemicals**

Refueling and maintenance for vehicles or equipment shall occur either within the designated washout area or shall utilize temporary drip protection measures at the location of fueling. The site supervisor or their representative shall be present at the time of any fueling procedure. The site supervisor shall have a fuel spill plan and measures on site to initiate containment and clean-up in the event a fuel spill occurs.

Refueling and maintenance of equipment shall take place in designated areas whenever possible. Refueling or maintenance of equipment in locations other than those designated for such activity shall be performed under the supervision of the site supervisor or his/her designee and shall employ drip pans or other suitable means of preventing fuel, hydraulic fluid, etc. from spilling or being otherwise carried offsite or into protected areas.

#### Maintenance Requirements

1. All emergency response equipment listed in the Emergency Response Equipment Inventory shall be made readily available and kept in a designated location known to the site supervisor or his/her designee. All such materials shall be replenished as necessary to the listed amounts.

#### **Hazardous or Toxic Waste**

(Note: Examples include paints, solvents, petroleum-based products, wood preservatives, additives, curing compounds, acids.)

Hazardous or toxic waste associated with paints, solvents, petroleum-based products, wood preservatives, additives, curing compounds, acids shall be collected in approved containers and disposed of in accordance with municipal, state and federal regulations.

Hazardous or toxic waste shall be collected in approved containers and disposed of in accordance with municipal, state and federal regulations. Hazardous and toxic waste shall not be disposed of in solid waste containers intended for non-hazardous construction debris.

#### Maintenance Requirements

1. The site supervisor shall regularly inspect all portions of the project under construction and ensure that all hazardous or toxic materials are disposed of in accordance with the practices detailed above and shall immediately correct any improper disposal practices.

#### **Construction and Domestic Waste**

(Note: Examples include packaging materials, scrap construction materials, masonry products, timber, pipe and electrical cuttings, plastics, styrofoam, concrete, and other trash or building materials.)

Construction and domestic waste shall be disposed of in a trash receptacle (dumpster) which shall be removed and disposed of at an approved land fill.

Recyclable waste material shall be stored in an appropriate container or in a designated location on site until it can be removed.

1. Trash receptacles (dumpsters) and recyclable waste material containers shall be located as needed throughout the site.

#### Maintenance Requirements

1. The site supervisor shall inspect all trash receptacles and containers to confirm that construction and domestic waste is properly contained and shall also ascertain that waste is being picked up in a timely manner to ensure that no receptacles are overflowing. Pick-up schedules shall be modified or the number of receptacles shall be increased as needed.

### **Sanitary Waste**

During the construction process, portable toilets will be provided in an appropriate location during the construction process.

#### Maintenance Requirements

1. The site supervisor shall execute a contract with a vendor to supply and maintain portable toilets throughout the site for the project duration. The site supervisor shall determine if a sufficient number of toilets are present to meet staffing levels and shall ensure that the toilets are regularly and properly maintained.

### **Washing of Applicators and Containers used for Paint, Concrete or Other Materials**

Concrete washout shall be restricted to designated areas. Paints, form release oils, curing compounds, etc. shall be recycled and/or disposed of utilizing appropriate containers in accordance with manufacturer's recommendations and EPA guidelines.

1. Install straw bale and plastic liner washout pit at the designated location on site. Concrete trucks shall wash out only at washout pit or other similar acceptable facility such as a portable roll-off washout pit.
2. Provide suitable containers for recycling or disposal for cleanup of paints, form release oils, curing compounds, etc.

#### Maintenance Requirements

1. The site supervisor shall inspect concrete washout pits (or other acceptable facility) to ensure that they are properly maintained. If necessary, wash water in a concrete washout pit shall be vacuumed off and the hardened concrete broken up and recycled. Wash water and broken up concrete shall be properly disposed of at a suitable facility. If necessary, the wash out pit shall be repaired and relined with plastic prior to continued use.
2. Containers for waste paint, form release oil, curing compounds, etc. shall be sealed and removed from the site and properly disposed of at a suitable facility. Empty containers shall replace those being removed for disposal.

## **Fertilizers**

Fertilizers shall be used only as necessary to establish vegetative stabilized slopes and disturbed areas. Apply at recommended rates. Use only slow release fertilizers to minimize discharge of nitrogen or phosphorous.

1. Store all fertilizers in designated locations. Store all weather sensitive materials in closed containers in accordance with manufacturer's recommendations.
2. To prevent accidental release of fertilizers, the site supervisor shall attempt to coordinate delivery of fertilizers to coincide with application and reduce the need to warehouse large quantities on-site.

### **Maintenance Requirements**

1. Site supervisor shall make regular inspections to ensure that fertilizer is being applied at proper rates and that all perimeter controls are in place and properly maintained to control runoff which may contain fertilizer. Stored fertilizer shall be properly covered or enclosed in a designated location to prevent introduction into stormwater runoff.

## **Spill Prevention and Response**

The site supervisor or their representative shall be present on the job site at all times during the course of work and shall be present during the delivery, removal of any liquid/chemical materials to or from the job site. They will also be present during any refueling practices. All subcontractors will be notified of their responsibilities in writing. In the event a spill occurs, the site supervisor shall be notified immediately.

The site supervisor shall have in place a spill prevention plan and resources to contain and clean up any potential spills in a timely manner. Refer to the following Spill Containment & Management Plan, including Spill Report, Emergency Response Equipment Inventory, and Emergency Notification and phone numbers.

## **Inspection/Maintenance:**

Operator personnel must inspect the construction site at least once every 14 calendar days and within 24 hours of a storm event of ½-inch or greater. The applicant shall be responsible to secure the services of a licensed engineer or similar professional (inspector) on an on-going basis throughout all phases of the project. Refer to the Inspection/Maintenance Requirements presented earlier in the "Structural and Stabilization Practices." The inspector should review the erosion and sediment controls with respect to the following:

- Whether or not the measure was installed/performed correctly.
- Whether or not there has been damage to the measure since it was installed or performed.
- What should be done to correct any problems with the measure.

The inspector should complete the Stormwater Management Construction Phase BMP Inspection Schedule and Evaluation Checklist, as attached, for documenting the findings and should request the required maintenance or repair for the pollution prevention measures when the inspector finds that it is necessary for the measure to be effective. The inspector should notify the appropriate person to make the changes and submit copies of the form to the Wellesley Department of Public Works – Engineering Division – Town Engineer upon request.

It is essential that the inspector document the inspection of the pollution prevention measures. These records will be used to request maintenance and repair and to prove that the inspection and maintenance were performed. The forms list each of the measures to be inspected on the site, the inspector's name, the date of the inspection, the condition of the measure/area inspected, maintenance or repair performed and any changes which should be made to the Pollution Prevention & Erosion and Sedimentation Control Plan to control or eliminate unforeseen pollution of storm water.

**Project Location: 148 Weston Road, Wellesley, MA**

**Date:**

**Stormwater Management – Construction Phase**

**Best Management Practices – Inspection Schedule and Evaluation Checklist**

**Construction Practices**

Best Management Practice	Inspection Frequency	Date Inspected	Inspector	Minimum Maintenance and Key Items to Check	Cleaning/Repair Needed: (List Items)	Date of Cleaning/Repair	Performed by
Siltsock Erosion Control Barrier	After heavy rainfall events (minimum weekly)			1. Sediment level 2. Material tears or repairs	<input type="checkbox"/> yes <input type="checkbox"/> no  		
Stabilized Construction Entrance	After heavy rainfall events (minimum weekly)			1. Sediment build-up or clogging	<input type="checkbox"/> yes <input type="checkbox"/> no  		
Inlet Protection	After heavy rainfall events (minimum weekly)			1. Sediment level 2. Sack tears or damage	<input type="checkbox"/> yes <input type="checkbox"/> no  		
Temporary Seeding	After heavy rainfall events (minimum weekly)				<input type="checkbox"/> yes <input type="checkbox"/> no  		
Geotextiles	After heavy rainfall events (minimum weekly)				<input type="checkbox"/> yes <input type="checkbox"/> no  		
Mulching & Netting	After heavy rainfall events (minimum weekly)				<input type="checkbox"/> yes <input type="checkbox"/> no  		
Land Grading	After heavy rainfall events (minimum weekly)				<input type="checkbox"/> yes <input type="checkbox"/> no  		

Topsoiling	After heavy rainfall events (minimum weekly)				<input type="checkbox"/> yes <input type="checkbox"/> no		
Permanent Seeding	After heavy rainfall events (minimum weekly)				<input type="checkbox"/> yes <input type="checkbox"/> no		
Dust Control	After heavy rainfall events (minimum weekly)				<input type="checkbox"/> yes <input type="checkbox"/> no		

**(1) Refer to the Massachusetts Stormwater Handbook issued January 2, 2008.**

**Notes (Include deviations from : Site Plan Approval or Order of Conditions, Construction Sequence and Approved Plan):**

**Stormwater Control Manager** \_\_\_\_\_

## **Spill Containment and Management Plan**

### **Initial Notification**

In the event of a spill, the facility manager will be notified immediately.

Facility Managers (name) \_\_\_\_\_  
Facility Manager (phone) \_\_\_\_\_

### **Assessment - Initial Containment**

The supervisor will assess the incident and initiate containment control measures with the appropriate spill containment equipment included in the spill kit kept on-site. The supervisor will first contact the Fire Department and then notify the Police Department, Department of Public Works, Board of Health and Conservation Commission. The fire department is ultimately responsible for matters of public health and safety and should be notified immediately.

Contact:	Phone Number:
Fire Department:	<u>911</u>
Police Department:	<u>911</u>
Department of Public Works:	<u>(781) 235-7600</u>
Board of Health Phone:	<u>(781) 235-0135</u>
Conservation Commission Phone:	<u>(781) 431 1019, ext. 2292</u>

### **Further Notification**

Based on the assessment from the Fire Chief, additional notification to a cleanup contractor may be made. The Massachusetts Department of Environmental Protection (DEP) and the EPA may be notified depending upon the nature and severity of the spill. The Fire Chief will be responsible for determining the level of cleanup and notification required. The attached list of emergency phone numbers shall be posted in the facility office and readily accessible to all employees.

## HAZARDOUS WASTE / OIL SPILL REPORT

Date\_\_\_\_ / \_\_\_\_ / \_\_\_\_

Time\_\_\_\_ AM / PM

Exact location (Transformer #)\_\_\_\_\_

Type of equipment\_\_\_\_\_ Make\_\_\_\_\_ Size\_\_\_\_\_

S / N\_\_\_\_\_ Weather Conditions\_\_\_\_\_

On or near water ☐ Yes If yes, name of body of water\_\_\_\_\_

☐ No

Type of chemical / oil spilled\_\_\_\_\_

Amount of chemical / oil spilled\_\_\_\_\_

Cause of spill\_\_\_\_\_

\_\_\_\_\_

Measures taken to contain or clean up spill\_\_\_\_\_

\_\_\_\_\_

Amount of chemical / oil recovered\_\_\_\_\_ Method\_\_\_\_\_

Material collected as a result of clean up

\_\_\_\_\_ drums containing\_\_\_\_\_

\_\_\_\_\_ drums containing\_\_\_\_\_

\_\_\_\_\_ drums containing\_\_\_\_\_

Location and method of debris disposal\_\_\_\_\_

\_\_\_\_\_

Name and address of any person, firm, or corporation suffering damages\_\_\_\_\_

\_\_\_\_\_

Procedures, method, and precautions instituted to prevent a similar occurrence from recurring\_\_\_\_\_

\_\_\_\_\_

Spill reported to General Office by\_\_\_\_\_ Time\_\_\_\_\_ AM / PM

Spill reported to DEP / National Response Center by\_\_\_\_\_

DEP Date\_\_\_\_ / \_\_\_\_ / \_\_\_\_ Time\_\_\_\_\_ AM / PM Inspector\_\_\_\_\_

NRC Date\_\_\_\_ / \_\_\_\_ / \_\_\_\_ Time\_\_\_\_\_ AM / PM Inspector\_\_\_\_\_

Additional comments\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## **EMERGENCY RESPONSE EQUIPMENT INVENTORY**

The following equipment and materials shall be maintained at all times and stored in a secure area for long-term emergency response need.

--	SORBENT PADS	1 BALE
--	SAND BAGS (empty)	5
--	SPEEDI-DRI ABSORBENT	1 – 40LB BAGS
--	SQUARE END SHOVELS	1
--	PRY BAR	1

## EMERGENCY NOTIFICATION PHONE NUMBERS

1. FACILITY MANAGER  
NAME: \_\_\_\_\_ BEEPER: \_\_\_\_\_  
PHONE: \_\_\_\_\_ CELL PHONE: \_\_\_\_\_  
  
ALTERNATE:  
NAME: \_\_\_\_\_ BEEPER: N/A \_\_\_\_\_  
PHONE: \_\_\_\_\_ CEL PHONE: \_\_\_\_\_
2. FIRE DEPARTMENT  
EMERGENCY: 911  
BUSINESS: (781) 235-1300  
  
POLICE DEPARTMENT  
EMERGENCY: 911  
BUSINESS: (781) 235-1212
3. MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION  
EMERGENCY: (617) 556-1133  
NORTHEAST REGION - WILMINGTON OFFICE: (978) 694-3200
4. NATIONAL RESPONSE CENTER  
PHONE: (800) 424-8802  
  
ALTERNATE: U.S. ENVIRONMENTAL PROTECTION AGENCY  
EMERGENCY: (617) 223-7265  
BUSINESS: (617) 860-4300
5. DEPARTMENT OF PUBLIC WORKS  
CONTACT: Town Engineer, David J. Hickey, Jr., P.E.  
PHONE: (781) 235-7600
6. WETLAND PROTECTION COMMITTEE  
CONTACT: Wetlands Administrator, Julie Meyer  
PHONE: (781) 431 1019, Ext. 2292
7. BOARD OF HEALTH  
CONTACT: Director. Community and Public Health Leonard Izzo, MS, RS, CHO  
PHONE: (781) 235-0135

**Post-Development Phase Best Management Practices Operation and  
Maintenance Plan /  
Long-Term Pollution Prevention Plan**

*for*

**140-148 Weston Road  
Wellesley, Massachusetts**

***Submitted to:*  
Town of Wellesley**

***Prepared for:*  
Wellesley Park, LLC  
49 Coolidge Street  
Brookline, Massachusetts 02466**

***Prepared by:***



**Professional Civil Engineering • Project Management • Land Planning  
150 Longwater Drive, Suite 101, Norwell, Massachusetts 02061  
Tel.: (781) 792-3900 Facsimile: (781) 792-0333  
[www.mckeng.com](http://www.mckeng.com)**

**February 28, 2020**

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**Post-Development Best Management Practice**  
**Operation and Maintenance Plan &**  
**Long-Term Pollution Prevention Plan**

**Post-Development Best Management Practices (BMPs)**  
**Operation and Maintenance Plan**

Responsible Party/Property Owner/Developer contact information:

Property Owner:

Wellesley Park, LLC  
49 Coolidge Street  
Brookline, MA 02446

Developer Contact Information:

Wellesley Park, LLC  
49 Coolidge Street Street  
Brookline, MA 02446

Town of Wellesley Contact Information:

Wellesley Department of Public Works – Engineering Division  
David J. Hickey, Jr., P.E., Town Engineer  
20 Municipal Way  
Wellesley, MA 02481  
Phone: 781-237-0047  
Fax: 781-237-0047

Wellesley Protection Committee  
Julie Meyer, Wetlands Administrator  
525 Washington Street  
Wellesley, MA 02482  
Phone: 781-431-1019, ext. 2292

Wellesley Building Department  
Michael T. Grant, Inspector of Buildings  
525 Washington Street  
Wellesley, MA 02482  
Phone: 781-431-1019

**Long-Term Operations and Maintenance**  
**General Conditions**

1. The property owner shall be responsible for scheduling regular inspections and maintenance of the stormwater BMP's as illustrated on the design plans and detailed in the following long-term operations and maintenance plan.
2. All Stormwater BMP's shall be operated and maintained in accordance with the design plans and the following Long-Term Operations and Maintenance Plan.

3. The owner shall:
  - a. Maintain an Operation and Maintenance Log (see Attachment A) for the last three years. The Log shall include all BMP inspections, repairs, replacement activities and disposal activities (disposal material and disposal location shall be included in the Log);
  - b. Make the log available to the Wellesley Department of Public Works - Town Engineer on an annual basis;
  - c. Allow members and agents of the Wellesley Department of Public Works to enter the premises and ensure that the Owner has complied with the Operation and Maintenance Plan requirements for each BMP.
4. A recommended inspection and maintenance schedule is outlined below based on statewide averages. This inspection and maintenance schedule should be adhered to at a minimum for the first year of service of all BMP's referenced in this document. At the commencement of the first year of service, a more accurate inspection/maintenance schedule should be determined based on the level of service for this site.

#### **Best Management Practices Operations and Maintenance**

1. **Paved Areas** –Sweepers shall sweep paved areas periodically during dry weather to remove excess sediments and to reduce the amount of sediments that the drainage system shall have to remove from the runoff. The sweeping shall be conducted primarily between March 15<sup>th</sup> and November 15<sup>th</sup>. Special attention should be made to sweeping paved surfaces in March and April before spring rains wash residual sand into the drainage system.

The frequency of sweeping shall average:

- Monthly if by a high-efficiency vacuum sweeper
- Bi-weekly if by a regenerative air sweeper
- Weekly if by a mechanical sweeper

Salt used for de-icing on the parking lot during winter months shall be limited as much as possible as this will reduce the need for removal and treatment. Sand containing the minimum amount of calcium chloride (or approved equivalent) needed for handling may be applied as part of the routine winter maintenance activities.

Cost: The property owner should consult local sweeping contractors for detailed cost estimates.

2. **Catch Basins** - Catch basin grates shall be checked quarterly and following heavy rainfalls to verify that the inlet openings are not clogged by debris. Debris shall be removed from the grates and disposed of properly. Deep sump catch basins shall be inspected and cleaned bi-annually of all accumulated sediments. Catch basins with hoods shall be inspected annually to check oil build-up and outlet obstructions. Material shall be removed from catch basins and disposed of in accordance with all applicable regulations.

Cost: Estimated \$50 - \$100 per cleaning as needed. The property owner should consult local vacuum cleaning contractors for detailed cost estimates.

- 3. Proprietary Pretreatment Units** – The proprietary pretreatment units shall be inspected and maintained from the surface, without entry into the unit a minimum of annually and following heavy rain events. Perform maintenance once the stored volume reaches 15% of the unit capacity, or immediately in the event of a spill. Perform Maintenance at quarterly intervals during the first year of installation, so an accurate maintenance schedule can be established. Sediment and debris should be removed through the 24-inch diameter outlet riser pipe. Alternatively, oil and floatables should be removed through the 18-inch oil inspection port. The requirements for the disposal from the units should be in compliance with all local, state and federal regulations. Consult the Pembroke Board of Health for transfer station locations prior to disposing the separator contents. Please refer to the Manufacturer's Manual for additional detail on proper inspection and maintenance of the First Defense units.

Cost: Cleaning should be included along with the routine maintenance of the catch basins. The property owner should consult local vacuum cleaning contractors for detailed cost estimates.

- 4. Subsurface Infiltration Chamber System** - Proper maintenance of the subsurface infiltration system is essential to the long-term effectiveness of the infiltration function. The subsurface infiltration system shall have inspection ports and additional inspections should be scheduled during the first few months to ensure proper stabilization and function. Thereafter, they shall be checked semiannually and following heavy rainfalls, defined as a 1-year storm event exceeding 2.5 inches of rainfall within a twenty-four-hour period. Water levels in the chambers shall be checked to verify proper drainage. Ponding water in a chamber indicates failure from the bottom. If water remains within the chambers after 48-hours following a storm event, steps to restore the infiltration function shall be taken, as directed by a qualified stormwater management professional. In order to rectify the problem, accumulated sediment must be removed from the bottom of the chamber. The stone aggregate and filter fabric must be removed and replaced and the underlying soil layer must be scarified to encourage proper infiltration. Material removed from the system shall be disposed of in accordance with all applicable local, state, and federal regulations. Please refer to the Manufacturer's Manual for additional detail on proper inspection and maintenance of the Cultec chambers.

Cost: The property owner should consult local landscape contractors for a detailed cost estimate.

- 5. Trench Drains** - Trench drain grates shall be checked quarterly and following heavy rainfalls to verify that the inlet openings are not clogged by debris. Debris shall be removed from the grates and disposed of in accordance with all applicable regulations.

Cost: Estimated \$50 - \$100 per cleaning as needed. The Owner should consult local vacuum cleaning contractors for detailed cost estimates.

- 6. Pesticides, Herbicides, and Fertilizers** - Pesticides and herbicides shall be used sparingly. Fertilizers should be restricted to the use of organic fertilizers only.

All structural BMP's as identified on the site plans will be owned and maintained by the homeowner's association of the development and shall run with the title of the property.

Cost: Included in the routine landscaping maintenance schedule. The Owner should consult local landscaping contractors for details.

- 7. Snow Removal** - Snow accumulations removed from driveway, fire lane and parking area should be placed in upland areas only, where sand and other debris will remain after snowmelt for later removal. Excess snow should be removed from the site and properly disposed of in an approved snow disposal facility.

Cost: The owner should consult local snow removal contractors for a detailed cost estimate.

### **Maintenance Responsibilities**

All post construction maintenance activities should be documented and kept on file and made available to the Wellesley Department of Public Works – Town Engineer on an annual basis.

To develop and implement an operation and maintenance program with the goal of preventing or reducing pollutant runoff by keeping potential pollutants from coming into contact with stormwater or being transported off site without treatment, the following efforts will be made:

- Property Management awareness and training on how to incorporate pollution prevention techniques into maintenance operations.
- Follow appropriate best management practices (BMPs) by proper maintenance and inspection procedures.

### **Long-Term Pollution Prevention Plan**

#### **Good Housekeeping:**

#### **Storage and Disposal of Waste and Toxics:**

Failure to properly store hazardous materials dramatically increases the probability that they will end up in local waterways. Practices such as covering hazardous materials or even storing them properly, can have dramatic impacts.

The exterior storage of hazardous materials on site shall be prohibited.

The following is a list of management considerations for hazardous materials as outlined by the EPA:

- Ensuring sufficient aisle space to provide access for inspections and to improve the ease of material transport;
- Storing materials well away from high-traffic areas to reduce the likelihood of accidents that might cause spills or damage to drums, bags, or containers.
- Stacking containers in accordance with the manufacturers' directions to avoid damaging the container or the product itself;

- Storing containers on pallets or equivalent structures. This facilitates inspection for leaks and prevents the containers from coming into contact with wet floors, which can cause corrosion. This consideration also reduces the incidence of damage by pests.

### **Landscape Maintenance:**

Using proper landscaping techniques can effectively increase the value of a property while benefiting the environment. These practices can benefit the environment by reducing water use; decreasing energy use (because less water pumping and treatment is required); minimizing runoff of storm and irrigation water that transports soils, fertilizers, and pesticides; and creating additional habitat for plants and wildlife. The following lawn and landscaping management practices will be encouraged:

- Mow lawn areas at the highest recommended height.
- Minimize lawn size and maintain existing native vegetation.
- Abide by water restrictions and other conservation measures implemented by the Town of Pembroke.
- Water only when necessary.
- Use automatic irrigation systems to reduce water use.

### **Integrated Pest Management (IPM):**

This management measure seeks to limit the adverse impacts of insecticides and herbicides by providing information on alternative pest control techniques other than chemicals or explaining how to determine the correct dosages needed to manage pests.

The presence of pesticides in stormwater runoff has a direct impact on the health of aquatic organisms and can present a threat to humans through contamination of drinking water supplies. The pesticides of greatest concern are insecticides, such as diazinon and chlorpyrifos, which even at very low levels can be harmful to aquatic life.

The following IPM practices will be encouraged:

- Pesticides and herbicides shall be used sparingly. Fertilizers should be restricted to the use of organic fertilizers only.
- Lawn care and landscaping management programs including appropriate pesticide use management as part of program.

### **Illicit Discharges:**

Illicit discharges are non-stormwater discharges to the storm drain system which typically contain bacteria and other pollutants. All illicit discharges are prohibited. Any illicit discharges should be reported to the Wellesley Department of Public Works to be addressed in accordance with their respective policies.

The following is a list of EPA allowed non-stormwater discharges. If the non-stormwater discharge is not listed, it is prohibited.

1. Water line flushing,
2. Landscape irrigation,
3. Diverted stream flows,
4. Rising ground waters,

5. Uncontaminated ground water infiltration (as defined at 40 CFR 35.2005(20)),
6. Uncontaminated pumped ground water,
7. Discharge from potable water sources,
8. Foundation drains,
9. Air conditioning condensation,
10. Irrigation water, springs,
11. Water from crawl space pumps,
12. Footing drains,
13. Lawn watering,
14. Flows from riparian habitats and wetlands,
15. Street wash water,
16. Discharges or flows from firefighting activities occur during emergency conditions.

**Project Location: 148 Weston Road, Wellesley, MA**

**Date:**

**Stormwater Management – Long Term**

**Best Management Practices – Inspection Schedule and Evaluation Checklist**

**Long Term Practices**

<b>Best Management Practice</b>	<b>Inspection Frequency</b>	<b>Date Inspected</b>	<b>Inspector</b>	<b>Minimum Maintenance and Key Items to Check</b>	<b>Cleaning/Repair Needed: (List Items)</b>	<b>Date of Cleaning/ Repair</b>	<b>Performed by</b>
Parking Lot Maintenance	4-times annually - specifically in Spring and Fall			1. Sediment build-up 2. Trash and debris 3. Minor Spills (vehicular)	<input type="checkbox"/> yes <input type="checkbox"/> no		
Catch Basins	After heavy rainfall events (minimum quarterly)			1. Sediment level exceeds 8" 2. Trash and debris 3. Floatable oils or hydrocarbons 4. Grate or outlet blockages	<input type="checkbox"/> yes <input type="checkbox"/> no		
Proprietary Stormwater Treatment Units	After heavy rainfall events (minimum annually)			1. Sediment level exceeds Manufacturer's specification 2. Trash and debris 3. Floatable oils or hydrocarbons 4. Outlet blockages	<input type="checkbox"/> yes <input type="checkbox"/> no		
Subsurface Infiltration Chambers System	After heavy rainfall events (minimum semi-annually)			1. Sediment build-up 2. Standing Water greater than 48 hours	<input type="checkbox"/> yes <input type="checkbox"/> no		
Trench Drains	After heavy rainfall events (minimum quarterly)			1. Sediment level exceeds 8" 2. Trash and debris 3. Floatable oils or hydrocarbons 4. Grate or outlet blockages	<input type="checkbox"/> yes <input type="checkbox"/> no		

**(1) Refer to the Massachusetts Stormwater Handbook issued January 2, 2008.**

**Notes (Include deviations from: Site Plan Approval and Order of Conditions and Approved Plans):**

**1. Limited or no use of sodium chloride slats, fertilizers or pesticides recommended. Slow release fertilizer recommended if necessary.**

**Stormwater Control Manager** \_\_\_\_\_

## **Spill Containment and Management Plan**

### **Initial Notification**

In the event of a spill, the facility manager will be notified immediately.

Facility Managers (name) \_\_\_\_\_  
Facility Manager (phone) \_\_\_\_\_

### **Assessment - Initial Containment**

The supervisor will assess the incident and initiate containment control measures with the appropriate spill containment equipment included in the spill kit kept on-site. The supervisor will first contact the Fire Department and then notify the Police Department, Department of Public Works, Board of Health and Conservation Commission. The fire department is ultimately responsible for matters of public health and safety and should be notified immediately.

Contact:	Phone Number:
Fire Department:	<u>911</u>
Police Department:	<u>911</u>
Department of Public Works:	<u>(781) 235-7600</u>
Board of Health Phone:	<u>(781) 235-0135</u>
Conservation Commission Phone:	<u>(781) 431 1019, ext. 2292</u>

### **Further Notification**

Based on the assessment from the Fire Chief, additional notification to a cleanup contractor may be made. The Massachusetts Department of Environmental Protection (DEP) and the EPA may be notified depending upon the nature and severity of the spill. The Fire Chief will be responsible for determining the level of cleanup and notification required. The attached list of emergency phone numbers shall be posted in the facility office and readily accessible to all employees.

## HAZARDOUS WASTE / OIL SPILL REPORT

Date\_\_\_\_/\_\_\_\_/\_\_\_\_

Time\_\_\_\_AM / PM

Exact location (Transformer #)\_\_\_\_\_

Type of equipment\_\_\_\_\_Make\_\_\_\_\_Size\_\_\_\_\_

S / N\_\_\_\_\_Weather Conditions\_\_\_\_\_

On or near water ☐ Yes If yes, name of body of water\_\_\_\_\_

☐ No

Type of chemical / oil spilled\_\_\_\_\_

Amount of chemical / oil spilled\_\_\_\_\_

Cause of spill\_\_\_\_\_

\_\_\_\_\_

Measures taken to contain or clean up spill\_\_\_\_\_

\_\_\_\_\_

Amount of chemical / oil recovered\_\_\_\_\_Method\_\_\_\_\_

Material collected as a result of clean up

\_\_\_\_\_drums containing\_\_\_\_\_

\_\_\_\_\_drums containing\_\_\_\_\_

\_\_\_\_\_drums containing\_\_\_\_\_

Location and method of debris disposal\_\_\_\_\_

\_\_\_\_\_

Name and address of any person, firm, or corporation suffering damages\_\_\_\_\_

\_\_\_\_\_

Procedures, method, and precautions instituted to prevent a similar occurrence from recurring\_\_\_\_\_

\_\_\_\_\_

Spill reported to General Office by\_\_\_\_\_Time\_\_\_\_\_AM / PM

Spill reported to DEP / National Response Center by\_\_\_\_\_

DEP Date\_\_\_\_/\_\_\_\_/\_\_\_\_Time\_\_\_\_\_AM / PM Inspector\_\_\_\_\_

NRC Date\_\_\_\_/\_\_\_\_/\_\_\_\_Time\_\_\_\_\_AM / PM Inspector\_\_\_\_\_

Additional comments\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

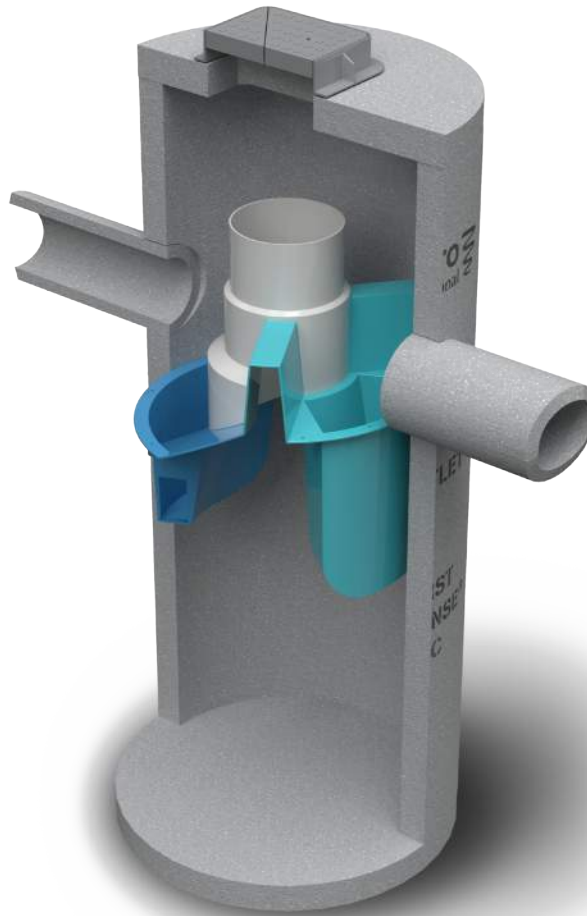
## **EMERGENCY RESPONSE EQUIPMENT INVENTORY**

The following equipment and materials shall be maintained at all times and stored in a secure area for long-term emergency response need.

--	SORBENT PADS	1 BALE
--	SAND BAGS (empty)	5
--	SPEEDI-DRI ABSORBENT	1 – 40LB BAGS
--	SQUARE END SHOVELS	1
--	PRY BAR	1

## EMERGENCY NOTIFICATION PHONE NUMBERS

1. FACILITY MANAGER  
NAME: \_\_\_\_\_ BEEPER: \_\_\_\_\_  
PHONE: \_\_\_\_\_ CELL PHONE: \_\_\_\_\_  
  
ALTERNATE:  
NAME: \_\_\_\_\_ BEEPER: N/A \_\_\_\_\_  
PHONE: \_\_\_\_\_ CEL PHONE: \_\_\_\_\_
2. FIRE DEPARTMENT  
EMERGENCY: 911  
BUSINESS: (781) 235-1300  
  
POLICE DEPARTMENT  
EMERGENCY: 911  
BUSINESS: (781) 235-1212
3. MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION  
EMERGENCY: (617) 556-1133  
NORTHEAST REGION - WILMINGTON OFFICE: (978) 694-3200
4. NATIONAL RESPONSE CENTER  
PHONE: (800) 424-8802  
  
ALTERNATE: U.S. ENVIRONMENTAL PROTECTION AGENCY  
EMERGENCY: (617) 223-7265  
BUSINESS: (617) 860-4300
5. DEPARTMENT OF PUBLIC WORKS  
CONTACT: Town Engineer, David J. Hickey, Jr., P.E.  
PHONE: (781) 235-7600
6. WETLAND PROTECTION COMMITTEE  
CONTACT: Wetlands Administrator, Julie Meyer  
PHONE: (781) 431 1019, Ext. 2292
7. BOARD OF HEALTH  
CONTACT: Director. Community and Public Health Leonard Izzo, MS, RS, CHO  
PHONE: (781) 235-0135



## Operation and Maintenance Manual

**First Defense® and First Defense® High Capacity**

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Vortex Separator for Stormwater Treatment

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**DISCLAIMER:** Information and data contained in this manual is exclusively for the purpose of assisting in the operation and maintenance of Hydro International plc’s First Defense®. No warranty is given nor can liability be accepted for use of this information for any other purpose. Hydro International plc has a policy of continuous product development and reserves the right to amend specifications without notice.

I. First Defense® by Hydro International

Introduction

The First Defense® is an enhanced vortex separator that combines an effective and economical stormwater treatment chamber with an integral peak flow bypass. It efficiently removes total suspended solids (TSS), trash and hydrocarbons from stormwater runoff without washing out previously captured pollutants. The First Defense® is available in several model configurations (refer to *Section II. Model Sizes & Configurations*, page 4) to accommodate a wide range of pipe sizes, peak flows and depth constraints.

Operation

The First Defense® operates on simple fluid hydraulics. It is self-activating, has no moving parts, no external power requirement and is fabricated with durable non-corrosive components. No manual procedures are required to operate the unit and maintenance is limited to monitoring accumulations of stored pollutants and periodic clean-outs. The First Defense® has been designed to allow for easy and safe access for inspection, monitoring and clean-out procedures. Neither entry into the unit nor removal of the internal components is necessary for maintenance, thus safety concerns related to confined-space-entry are avoided.

Pollutant Capture and Retention

The internal components of the First Defense® have been designed to optimize pollutant capture. Sediment is captured and retained in the base of the unit, while oil and floatables are stored on the water surface in the inner volume (Fig.1).

The pollutant storage volumes are isolated from the built-in bypass chamber to prevent washout during high-flow storm events. The sump of the First Defense® retains a standing water level between storm events. This ensures a quiescent flow regime at the onset of a storm, preventing resuspension and washout of pollutants captured during previous events.

Accessories such as oil absorbent pads are available for enhanced oil removal and storage. Due to the separation of the oil and floatable storage volume from the outlet, the potential for washout of stored pollutants between clean-outs is minimized.

Applications

- Stormwater treatment at the point of entry into the drainage line
- Sites constrained by space, topography or drainage profiles with limited slope and depth of cover
- Retrofit installations where stormwater treatment is placed on or tied into an existing storm drain line
- Pretreatment for filters, infiltration and storage

Advantages

- Inlet options include surface grate or multiple inlet pipes
- Integral high capacity bypass conveys large peak flows without the need for “offline” arrangements using separate junction manholes
- Proven to prevent pollutant washout at up to 500% of its treatment flow
- Long flow path through the device ensures a long residence time within the treatment chamber, enhancing pollutant settling
- Delivered to site pre-assembled and ready for installation

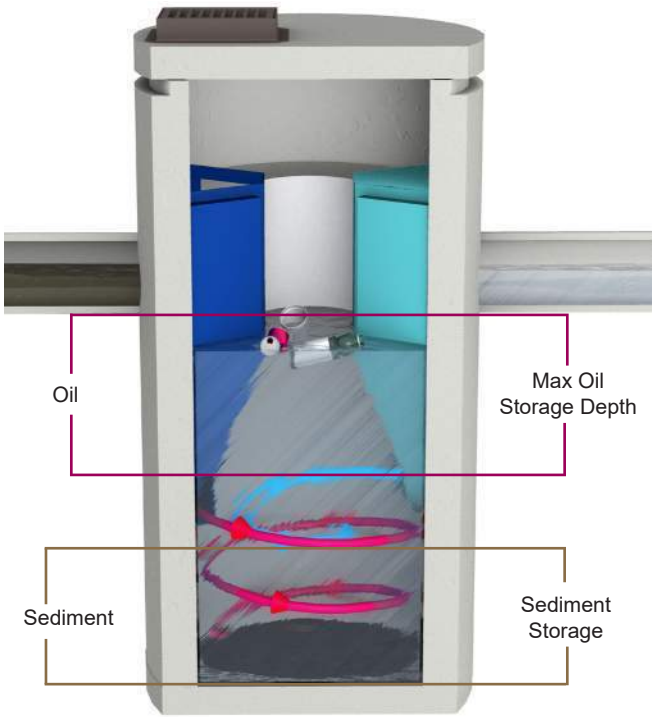


Fig.1 Pollutant storage volumes in the First Defense®.

II. Model Sizes & Configurations

The First Defense® inlet and internal bypass arrangements are available in several model sizes and configurations. The components of the First Defense®-4HC and First Defense®-6HC have modified geometries as to allow greater design flexibility needed to accommodate various site constraints.

All First Defense® models include the internal components that are designed to remove and retain total suspended solids (TSS), gross solids, floatable trash and hydrocarbons (Fig.2a - 2b). First Defense® model parameters and design criteria are shown in Table 1.

First Defense® Components

1. Built-In Bypass

2. Inlet Pipe

3. Inlet Chute
4. Floatables Draw-off Port

5. Outlet Pipe

6. Floatables Storage
7. Sediment Storage

8. Inlet Grate or Cover

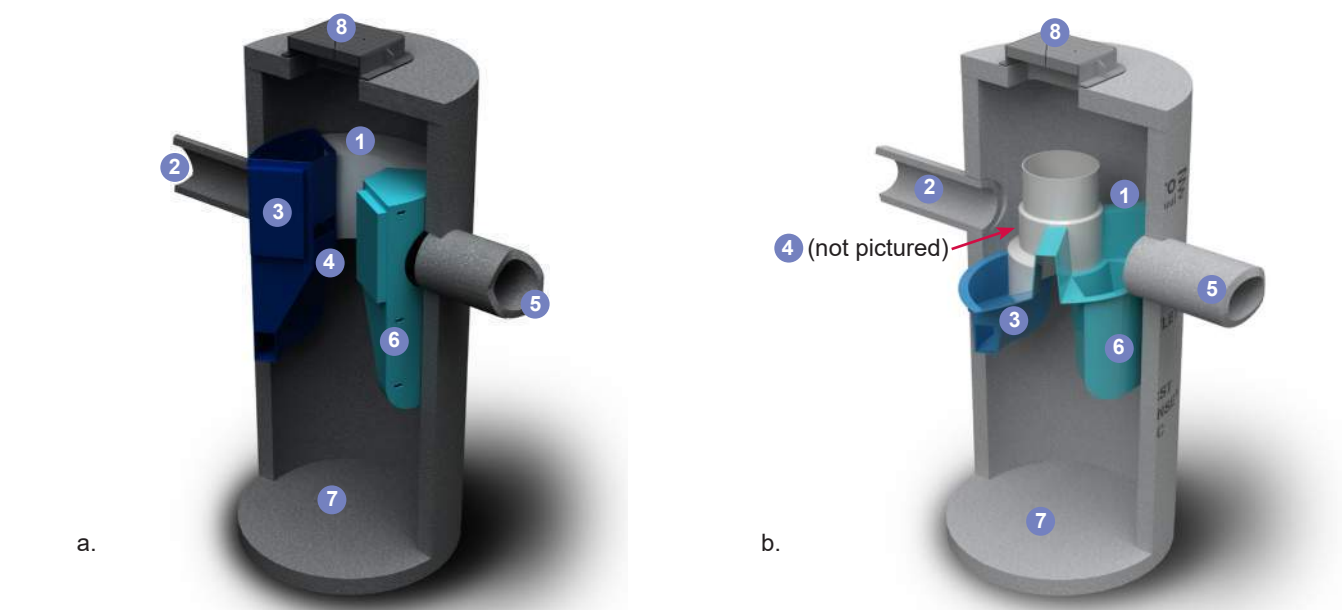


Fig.2a) First Defense®-4 and First Defense®-6; b) First Defense®-4HC and First Defense®-6HC, with higher capacity dual internal bypass and larger maximum pipe diameter.

First Defense® High Capacity Model Number	Diameter	Typical TSS Treatment Flow Rates	Peak Online Flow Rate	Maximum Pipe Diameter¹	Oil Storage Capacity	Typical Sediment Storage Capacity²	Minimum Distance from Outlet Invert to Top of Rim³	Chamber Depth
		NJDEP Certified						
	(ft / m)	(cfs / L/s)	(cfs / L/s)	(in / mm)	(gal / L)	(yd³ / m³)	(ft / m)	(ft / m)
FD-3HC	3 / 0.9	0.85 / 24.0	15 / 424	18 / 457	125 / 473	0.4 / 0.3	2.0 - 3.5 / 0.6 - 1.0	3.75 / 1.14
FD-4HC	4 / 1.2	1.50 / 42.4	18 / 510	24 / 600	191 / 723	0.7 / 0.5	2.3 - 3.9 / 0.7 - 1.2	5.00 / 1.52
FD-5HC	5 / 1.5	2.35 / 66.2	20 / 566	24 / 609	300 / 1135	1.1 / .84	2.5 - 4.5 / 0.7 - 1.3	5.25 / 1.60
FD-6HC	6 / 1.8	3.38 / 95.7	32 / 906	30 / 750	496 / 1878	1.6 / 1.2	3.0 - 5.1 / 0.9 - 1.6	6.25 / 1.90
FD-7HC	7 / 2.1	4.60 / 130.2	40 / 1133	42 / 1067	750 / 2839	2.1 / 1.9	3.0 - 5.5 / 0.9 - 1.7	7.25 / 2.20
FD-8HC	8 / 2.4	6.00 / 169.9	50 / 1,415	48 / 1219	1120 / 4239	2.8 / 2.1	3.0 - 6.0 / 0.9 -1.8	8.00 / 2.43

¹Contact Hydro International when larger pipe sizes are required.  
²Contact Hydro International when custom sediment storage capacity is required.  
³Minimum distance for models depends on pipe diameter.

III. Maintenance

Overview

The First Defense® protects the environment by removing a wide range of pollutants from stormwater runoff. Periodic removal of these captured pollutants is essential to the continuous, long-term functioning of the First Defense®. The First Defense® will capture and retain sediment and oil until the sediment and oil storage volumes are full to capacity. When sediment and oil storage capacities are reached, the First Defense® will no longer be able to store removed sediment and oil. Maximum pollutant storage capacities are provided in Table 1.

The First Defense® allows for easy and safe inspection, monitoring and clean-out procedures. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables. Access ports are located in the top of the manhole.

Maintenance events may include Inspection, Oil & Floatables Removal, and Sediment Removal. Maintenance events do not require entry into the First Defense®, nor do they require the internal components of the First Defense® to be removed. In the case of inspection and floatables removal, a vactor truck is not required. However, a vactor truck is required if the maintenance event is to include oil removal and/or sediment removal.

Maintenance Equipment Considerations

The internal components of the First Defense®-HC have a centrally located circular shaft through which the sediment storage sump can be accessed with a sump vac hose. The open diameter of this access shaft is 15 inches in diameter (Fig.3). Therefore, the nozzle fitting of any vactor hose used for maintenance should be less than 15 inches in diameter.

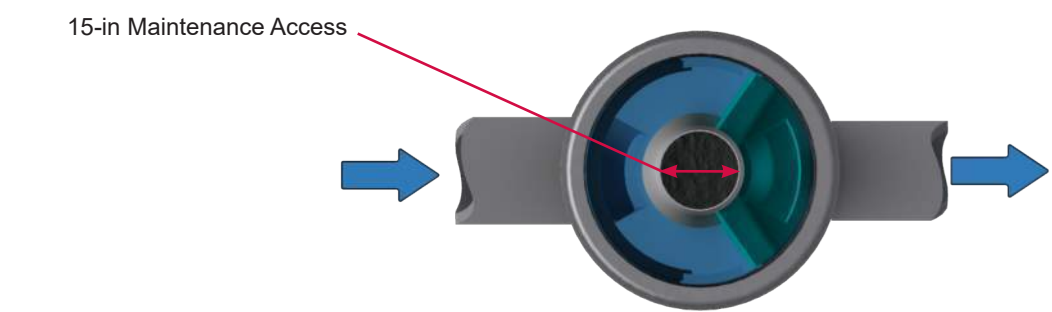


Fig.3 The central opening to the sump of the First Defense®-HC is 15 inches in diameter.

Determining Your Maintenance Schedule

The frequency of clean out is determined in the field after installation. During the first year of operation, the unit should be inspected every six months to determine the rate of sediment and floatables accumulation. A simple probe such as a Sludge-Judge® can be used to determine the level of accumulated solids stored in the sump. This information can be recorded in the maintenance log (see page 9) to establish a routine maintenance schedule.

The vactor procedure, including both sediment and oil / flotables removal, for a 6-ft First Defense® typically takes less than 30 minutes and removes a combined water/oil volume of about 765 gallons.

Inspection Procedures

1. Set up any necessary safety equipment around the access port or grate of the First Defense® as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.
2. Remove the grate or lid to the manhole.
3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities. Fig.4 shows the standing water level that should be observed.
4. Without entering the vessel, use the pole with the skimmer net to remove floatables and loose debris from the components and water surface.
5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel.
6. On the Maintenance Log (see page 9), record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components or blockages.
7. Securely replace the grate or lid.
8. Take down safety equipment.
9. Notify Hydro International of any irregularities noted during inspection.

Floatables and Sediment Clean Out

Floatables clean out is typically done in conjunction with sediment removal. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables (Fig.5).

Floatables and loose debris can also be netted with a skimmer and pole. The access port located at the top of the manhole provides unobstructed access for a vactor hose and skimmer pole to be lowered to the base of the sump.

Scheduling

- Floatables and sump clean out are typically conducted once a year during any season.
- Floatables and sump clean out should occur as soon as possible following a spill in the contributing drainage area.



Fig.4 Floatables are removed with a vactor hose (First Defense model FD-4, shown).

Recommended Equipment

- Safety Equipment (traffic cones, etc)
- Crow bar or other tool to remove grate or lid
- Pole with skimmer or net (if only floatables are being removed)
- Sediment probe (such as a Sludge Judge®)
- Vactor truck (flexible hose recommended)
- First Defense® Maintenance Log

Floatables and sediment Clean Out Procedures

1. Set up any necessary safety equipment around the access port or grate of the First Defense® as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.
2. Remove the grate or lid to the manhole.
3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities.
4. Remove oil and floatables stored on the surface of the water with the vactor hose (Fig.5) or with the skimmer or net (not pictured).
5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel and record it in the Maintenance Log (page 9).
6. Once all floatables have been removed, drop the vactor hose to the base of the sump. Vactor out the sediment and gross debris off the sump floor (Fig.5).
7. Retract the vactor hose from the vessel.
8. On the Maintenance Log provided by Hydro International, record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components, blockages, or irregularly high or low water levels.
9. Securely replace the grate or lid.



Fig.5 Sediment is removed with a vactor hose (First Defense model FD-4, shown).

Maintenance at a Glance

Inspection	- Regularly during first year of installation - Every 6 months after the first year of installation
Oil and Floatables Removal	- Once per year, with sediment removal - Following a spill in the drainage area
Sediment Removal	- Once per year or as needed - Following a spill in the drainage area
NOTE: For most clean outs the entire volume of liquid does not need to be removed from the manhole. Only remove the first few inches of oils and floatables from the water surface to reduce the total volume of liquid removed during a clean out.	



First Defense® Installation Log

HYDRO INTERNATIONAL REFERENCE NUMBER:	
SITE NAME:	
SITE LOCATION:	
OWNER:	CONTRACTOR:
CONTACT NAME:	CONTACT NAME:
COMPANY NAME:	COMPANY NAME:
ADDRESS:	ADDRESS:
TELEPHONE:	TELEPHONE:
FAX:	FAX:

INSTALLATION DATE:    /    /

MODEL SIZE (CIRCLE ONE):    FD-3HC    FD-4    FD-4HC    FD-5HC    FD-6    FD-6HC

FD-7HC    FD-8HC

INLET (CIRCLE ALL THAT APPLY):    GRATED INLET (CATCH BASIN)    INLET PIPE (FLOW THROUGH)



First Defense® Inspection and Maintenance Log

Date	Initials	Depth of Floatables and Oils	Sediment Depth Measured	Volume of Sediment Removed	Site Activity and Comments



## Stormwater Solutions

94 Hutchins Drive  
Portland, ME 04102

Tel: (207) 756-6200

Fax: (207) 756-6212

[stormwaterinquiry@hydro-int.com](mailto:stormwaterinquiry@hydro-int.com)

[www.hydro-int.com](http://www.hydro-int.com)

Turning Water Around...®

FDHC\_O+M\_H\_1703

# Contactor® & Recharger® Stormwater Chambers



## Operation and Maintenance Guidelines for CULTEC Stormwater Management Systems

The Founder of Plastic Chamber Technology

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# Operations and Maintenance Guidelines

Published by  
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[www.cultec.com](http://www.cultec.com)

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## Contact Information:

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For technical support, please call (203)775-4416 ext. 203 or e-mail [tech@cultec.com](mailto:tech@cultec.com).

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Doc ID: CULG008 05-17  
May 2017

*These instructions are for single-layer traffic applications only. For multi-layer applications, contact CULTEC.  
All illustrations and photos shown herein are examples of typical situations. Be sure to follow the engineer's drawings.  
Actual designs may vary.*

*This manual contains guidelines recommended by CULTEC, Inc. and may be used in conjunction with, but not to supersede, local regulations or regulatory authorities. OSHA Guidelines must be followed when inspecting or cleaning any structure.*

## Introduction

The CULTEC Subsurface Stormwater Management System is a high-density polyethylene (HDPE) chamber system arranged in parallel rows surrounded by washed stone. The CULTEC chambers create arch-shaped voids within the washed stone to provide stormwater detention, retention, infiltration, and reclamation. Filter fabric is placed between the native soil and stone interface to prevent the intrusion of fines into the system. In order to minimize the amount of sediment which may enter the CULTEC system, a sediment collection device (stormwater pretreatment device) is recommended upstream from the CULTEC chamber system. Examples of pretreatment devices include, but are not limited to, an appropriately sized catch basin with sump, pretreatment catchment device, oil grit separator, or baffled distribution box. Manufactured pretreatment devices may also be used in accordance with CULTEC chambers. Installation, operation, and maintenance of these devices shall be in accordance with manufacturer's recommendations. Almost all of the sediment entering the stormwater management system will be collected within the pretreatment device.

Best Management Practices allow for the maintenance of the preliminary collection systems prior to feeding the CULTEC chambers. The pretreatment structures shall be inspected for any debris that will restrict inlet flow rates. Outfall structures, if any, such as outlet control must also be inspected for any obstructions that would restrict outlet flow rates. OSHA Guidelines must be followed when inspecting or cleaning any structure.

## Operation and Maintenance Requirements

### I. Operation

CULTEC stormwater management systems shall be operated to receive only stormwater run-off in accordance with applicable local regulations. CULTEC subsurface stormwater management chambers operate at peak performance when installed in series with pretreatment. Pretreatment of suspended solids is superior to treatment of solids once they have been introduced into the system. The use of pretreatment is adequate as long as the structure is maintained and the site remains stable with finished impervious surfaces such as parking lots, walkways, and pervious areas are properly maintained. If there is to be an unstable condition, such as improvements to buildings or parking areas, all proper silt control measures shall be implemented according to local regulations.

### II. Inspection and Maintenance Options

- A. The CULTEC system may be equipped with an inspection port located on the inlet row. The inspection port is a circular cast box placed in a rectangular concrete collar. When the lid is removed, a 6-inch (150 mm) pipe with a screw-in plug will be exposed. Remove the plug. This will provide access to the CULTEC Chamber row below. From the surface, through this access, the sediment may be measured at this location. A stadia rod may be used to measure the depth of sediment if any in this row. If the depth of sediment is in excess of 3 inches (76 mm), then this row should be cleaned with high pressure water through a culvert cleaning nozzle. This would be carried out through an upstream manhole or through the CULTEC StormFilter Unit (or other pretreatment device). CCTV inspection of this row can be deployed through this access port to determine if any sediment has accumulated in the inlet row.
- B. If the CULTEC bed is not equipped with an inspection port, then access to the inlet row will be through an upstream manhole or the CULTEC StormFilter.
  1. **Manhole Access**  
This inspection should only be carried out by persons trained in confined space entry and sewer inspection services. After the manhole cover has been removed a gas detector must be lowered into the manhole to ensure that there are not high concentrations of toxic gases present. The inspector should be lowered into the manhole with the proper safety equipment as per OSHA requirements. The inspector may be able to observe sediment from this location. If this is not possible, the inspector will need to deploy a CCTV robot to permit viewing of the sediment.

## 2. StormFilter Access

Remove the manhole cover to allow access to the unit. Typically a 30-inch (750 mm) pipe is used as a riser from the StormFilter to the surface. As in the case with manhole access, this access point requires a technician trained in confined space entry with proper gas detection equipment. This individual must be equipped with the proper safety equipment for entry into the StormFilter. The technician will be lowered onto the StormFilter unit. The hatch on the unit must be removed. Inside the unit are two filters which may be removed according to StormFilter maintenance guidelines. Once these filters are removed the inspector can enter the StormFilter unit to launch the CCTV camera robot.

- C. The inlet row of the CULTEC system is placed on a polyethylene liner to prevent scouring of the washed stone beneath this row. This also facilitates the flushing of this row with high pressure water through a culvert cleaning nozzle. The nozzle is deployed through a manhole or the StormFilter and extended to the end of the row. The water is turned on and the inlet row is back-flushed into the manhole or StormFilter. This water is to be removed from the manhole or StormFilter using a vacuum truck.

## III. Maintenance Guidelines

The following guidelines shall be adhered to for the operation and maintenance of the CULTEC stormwater management system:

- A. The owner shall keep a maintenance log which shall include details of any events which would have an effect on the system's operational capacity.
- B. The operation and maintenance procedure shall be reviewed periodically and changed to meet site conditions.
- C. Maintenance of the stormwater management system shall be performed by qualified workers and shall follow applicable occupational health and safety requirements.
- D. Debris removed from the stormwater management system shall be disposed of in accordance with applicable laws and regulations.

## IV. Suggested Maintenance Schedules

### A. Minor Maintenance

The following suggested schedule shall be followed for routine maintenance during the regular operation of the stormwater system:

Frequency	Action
Monthly in first year	Check inlets and outlets for clogging and remove any debris, as required.
Spring and Fall	Check inlets and outlets for clogging and remove any debris, as required.
One year after commissioning and every third year following	Check inlets and outlets for clogging and remove any debris, as required.

### B. Major Maintenance

The following suggested maintenance schedule shall be followed to maintain the performance of the CULTEC stormwater management chambers. Additional work may be necessary due to insufficient performance and other issues that might be found during the inspection of the stormwater management chambers. (See table on next page)

	Frequency	Action
Inlets and Outlets	Every 3 years	<ul style="list-style-type: none"> <li>Obtain documentation that the inlets, outlets and vents have been cleaned and will function as intended.</li> </ul>
	Spring and Fall	<ul style="list-style-type: none"> <li>Check inlet and outlets for clogging and remove any debris as required.</li> </ul>
CULTEC Stormwater Chambers	2 years after commissioning	<ul style="list-style-type: none"> <li>Inspect the interior of the stormwater management chambers through inspection port for deficiencies using CCTV or comparable technique.</li> <li>Obtain documentation that the stormwater management chambers and feed connectors will function as anticipated.</li> </ul>
	9 years after commissioning every 9 years following	<ul style="list-style-type: none"> <li>Clean stormwater management chambers and feed connectors of any debris.</li> <li>Inspect the interior of the stormwater management structures for deficiencies using CCTV or comparable technique.</li> <li>Obtain documentation that the stormwater management chambers and feed connectors have been cleaned and will function as intended.</li> </ul>
	45 years after commissioning	<ul style="list-style-type: none"> <li>Clean stormwater management chambers and feed connectors of any debris.</li> <li>Determine the remaining life expectancy of the stormwater management chambers and recommended schedule and actions to rehabilitate the stormwater management chambers as required.</li> <li>Inspect the interior of the stormwater management chambers for deficiencies using CCTV or comparable technique.</li> <li>Replace or restore the stormwater management chambers in accordance with the schedule determined at the 45-year inspection.</li> <li>Attain the appropriate approvals as required.</li> <li>Establish a new operation and maintenance schedule.</li> </ul>
Surrounding Site	Monthly in 1 <sup>st</sup> year	<ul style="list-style-type: none"> <li>Check for depressions in areas over and surrounding the stormwater management system.</li> </ul>
	Spring and Fall	<ul style="list-style-type: none"> <li>Check for depressions in areas over and surrounding the stormwater management system.</li> </ul>
	Yearly	<ul style="list-style-type: none"> <li>Confirm that no unauthorized modifications have been performed to the site.</li> </ul>

For additional information concerning the maintenance of CULTEC Subsurface Stormwater Management Chambers, please contact CULTEC, Inc. at 1-800-428-5832.

## WQMP Operation & Maintenance (O&M) Plan

Project Name: \_\_\_\_\_

### Prepared for:

Project Name: \_\_\_\_\_

Address: \_\_\_\_\_

City, State Zip: \_\_\_\_\_

### Prepared on:

Date: \_\_\_\_\_

This O&M Plan describes the designated responsible party for implementation of this WQMP, including: operation and maintenance of all the structural BMP(s), conducting the training/educational program and duties, and any other necessary activities. The O&M Plan includes detailed inspection and maintenance requirements for all structural BMPs, including copies of any maintenance contract agreements, manufacturer's maintenance requirements, permits, etc.

### 8.1.1 Project Information

Project name	
Address	
City, State Zip	
Site size	
List of structural BMPs, number of each	
Other notes	

### 8.1.2 Responsible Party

The responsible party for implementation of this WQMP is:

Name of Person or HOA Property Manager	
Address	
City, State Zip	
Phone number	
24-Hour Emergency Contact number	
Email	

### 8.1.3 Record Keeping

Parties responsible for the O&M plan shall retain records for at least 5 years.

All training and educational activities and BMP operation and maintenance shall be documented to verify compliance with this O&M Plan. A sample Training Log and Inspection and Maintenance Log are included in this document.

### 8.1.4 Electronic Data Submittal

This document along with the Site Plan and Attachments shall be provided in PDF format. AutoCAD files and/or GIS coordinates of BMPs shall also be submitted to the City.

## Appendix \_\_\_\_

### **BMP SITE PLAN**

Site plan is preferred on minimum 11" by 17" colored sheets, as long as legible.



BMP OPERATION & MAINTENANCE LOG

Project Name: \_\_\_\_\_

Today’s Date:\_\_\_\_\_

Name of Person Performing Activity (Printed):\_\_\_\_\_

Signature: \_\_\_\_\_

BMP Name (As Shown in O&M Plan)	Brief Description of Implementation, Maintenance, and Inspection Activity Performed

## Minor Maintenance

Frequency		Action
<b>Monthly in first year</b>		Check inlets and outlets for clogging and remove any debris, as required.
		Notes
<input type="checkbox"/> Month 1	Date:	
<input type="checkbox"/> Month 2	Date:	
<input type="checkbox"/> Month 3	Date:	
<input type="checkbox"/> Month 4	Date:	
<input type="checkbox"/> Month 5	Date:	
<input type="checkbox"/> Month 6	Date:	
<input type="checkbox"/> Month 7	Date:	
<input type="checkbox"/> Month 8	Date:	
<input type="checkbox"/> Month 9	Date:	
<input type="checkbox"/> Month 10	Date:	
<input type="checkbox"/> Month 11	Date:	
<input type="checkbox"/> Month 12	Date:	
<b>Spring and Fall</b>		Check inlets and outlets for clogging and remove any debris, as required.
		Notes
<input type="checkbox"/> Spring	Date:	
<input type="checkbox"/> Fall	Date:	
<input type="checkbox"/> Spring	Date:	
<input type="checkbox"/> Fall	Date:	
<input type="checkbox"/> Spring	Date:	
<input type="checkbox"/> Fall	Date:	
<input type="checkbox"/> Spring	Date:	
<input type="checkbox"/> Fall	Date:	
<input type="checkbox"/> Spring	Date:	
<input type="checkbox"/> Fall	Date:	
<input type="checkbox"/> Spring	Date:	
<input type="checkbox"/> Fall	Date:	
<b>One year after commissioning and every third year following</b>		Check inlets and outlets for clogging and remove any debris, as required.
		Notes
<input type="checkbox"/> Year 1	Date:	
<input type="checkbox"/> Year 4	Date:	
<input type="checkbox"/> Year 7	Date:	
<input type="checkbox"/> Year 10	Date:	
<input type="checkbox"/> Year 13	Date:	
<input type="checkbox"/> Year 16	Date:	
<input type="checkbox"/> Year 19	Date:	
<input type="checkbox"/> Year 22	Date:	

## Major Maintenance

Frequency		Action
Inlets and Outlets	<b>Every 3 years</b>	Obtain documentation that the inlets, outlets and vents have been cleaned and will function as intended.
	Notes	
	<input type="checkbox"/> Year 1	Date:
	<input type="checkbox"/> Year 4	Date:
	<input type="checkbox"/> Year 7	Date:
	<input type="checkbox"/> Year 10	Date:
	<input type="checkbox"/> Year 13	Date:
	<input type="checkbox"/> Year 16	Date:
	<input type="checkbox"/> Year 19	Date:
	<input type="checkbox"/> Year 22	Date:
	<b>Spring and Fall</b>	Check inlet and outlets for clogging and remove any debris, as required.
	Notes	
	<input type="checkbox"/> Spring	Date:
	<input type="checkbox"/> Fall	Date:
	<input type="checkbox"/> Spring	Date:
	<input type="checkbox"/> Fall	Date:
	<input type="checkbox"/> Spring	Date:
	<input type="checkbox"/> Fall	Date:
	<input type="checkbox"/> Spring	Date:
	<input type="checkbox"/> Fall	Date:
	<input type="checkbox"/> Spring	Date:
	<input type="checkbox"/> Fall	Date:
CULTEC Stormwater Chambers	<b>2 years after commissioning</b>	<input type="checkbox"/> Inspect the interior of the stormwater management chambers through inspection port for deficiencies using CCTV or comparable technique. <input type="checkbox"/> Obtain documentation that the stormwater management chambers and feed connectors will function as anticipated.
	Notes	
	<input type="checkbox"/> Year 2	Date:

## Major Maintenance

Frequency		Action
CULTEC Stormwater Chambers	<b>9 years after commissioning every 9 years following</b>	<input type="checkbox"/> Clean stormwater management chambers and feed connectors of any debris.  <input type="checkbox"/> Inspect the interior of the stormwater management structures for deficiencies using CCTV or comparable technique.  <input type="checkbox"/> Obtain documentation that the stormwater management chambers and feed connectors have been cleaned and will function as intended.
	Notes	
	<input type="checkbox"/> Year 9	Date:
	<input type="checkbox"/> Year 18	Date:
	<input type="checkbox"/> Year 27	Date:
	<input type="checkbox"/> Year 36	Date:
	<b>45 years after commissioning</b>	<input type="checkbox"/> Clean stormwater management chambers and feed connectors of any debris.  <input type="checkbox"/> Determine the remaining life expectancy of the stormwater management chambers and recommended schedule and actions to rehabilitate the stormwater management chambers as required.  <input type="checkbox"/> Inspect the interior of the stormwater management chambers for deficiencies using CCTV or comparable technique.  <input type="checkbox"/> Replace or restore the stormwater management chambers in accordance with the schedule determined at the 45-year inspection.  <input type="checkbox"/> Attain the appropriate approvals as required.  <input type="checkbox"/> Establish a new operation and maintenance schedule.
	Notes	
	<input type="checkbox"/> Year 45	Date:

## Major Maintenance

Frequency		Action	
Surrounding Site	<b>Monthly in 1<sup>st</sup> year</b>		
	<input type="checkbox"/> Check for depressions in areas over and surrounding the stormwater management system.		
	Notes		
	<input type="checkbox"/> Month 1	Date:	
	<input type="checkbox"/> Month 2	Date:	
	<input type="checkbox"/> Month 3	Date:	
	<input type="checkbox"/> Month 4	Date:	
	<input type="checkbox"/> Month 5	Date:	
	<input type="checkbox"/> Month 6	Date:	
	<input type="checkbox"/> Month 7	Date:	
	<input type="checkbox"/> Month 8	Date:	
	<input type="checkbox"/> Month 9	Date:	
	<input type="checkbox"/> Month 10	Date:	
	<input type="checkbox"/> Month 11	Date:	
	<input type="checkbox"/> Month 12	Date:	
	<b>Spring and Fall</b>		
	<input type="checkbox"/> Check for depressions in areas over and surrounding the stormwater management system.		
	Notes		
	<input type="checkbox"/> Spring	Date:	
	<input type="checkbox"/> Fall	Date:	
	<input type="checkbox"/> Spring	Date:	
	<input type="checkbox"/> Fall	Date:	
	<input type="checkbox"/> Spring	Date:	
	<input type="checkbox"/> Fall	Date:	
	<input type="checkbox"/> Spring	Date:	
	<input type="checkbox"/> Fall	Date:	
	<input type="checkbox"/> Spring	Date:	
	<input type="checkbox"/> Fall	Date:	
	<input type="checkbox"/> Spring	Date:	
	<input type="checkbox"/> Fall	Date:	
	<b>Yearly</b>		
	<input type="checkbox"/> Confirm that no unauthorized modifications have been performed to the site.		
Notes			
<input type="checkbox"/> Year 1	Date:		
<input type="checkbox"/> Year 2	Date:		
<input type="checkbox"/> Year 3	Date:		
<input type="checkbox"/> Year 4	Date:		
<input type="checkbox"/> Year 5	Date:		
<input type="checkbox"/> Year 6	Date:		
<input type="checkbox"/> Year 7	Date:		



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CULG008 05-17



# R-TANK OPERATION, INSPECTION & MAINTENANCE

## Operation

Your ACF R-Tank System has been designed to function in conjunction with the engineered drainage system on your site, the existing municipal infrastructure, and/or the existing soils and geography of the receiving watershed. Unless your site included certain unique and rare features, the operation of your R-Tank System will be driven by naturally occurring systems and will function autonomously. However, upholding a proper schedule of Inspection & Maintenance is critical to ensuring continued functionality and optimum performance of the system.

## Inspection

Both the R-Tank and all stormwater pre-treatment features incorporated into your site must be inspected regularly. Inspection frequency for your system must be determined based on the contributing drainage area, but should never exceed one year between inspections (six months during the first year of operation).

Inspections may be required more frequently for pre-treatment systems. You should refer to the manufacturer requirements for the proper inspection schedule.

With the right equipment your inspection and measurements can be accomplished from the surface without physically entering any confined spaces. If your inspection does require confined space entry, you **MUST** follow all local/regional requirements as well as OSHA standards.

R-Tank Systems may incorporate Inspection Ports, Maintenance Ports, and/or adjoining manholes. Each of these features are easily accessed by removing the lid at the surface. With the cover removed, a visual inspection can be performed to identify sediment deposits within the structure. Using a flashlight, ALL access points should be examined to complete a thorough inspection.

### Inspection Ports

Usually located centrally in the R-Tank System, these perforated columns are designed to give the user a base-line sediment depth across the system floor.

### Maintenance Ports

Usually located near the inlet and outlet connections, you'll likely find deeper deposits of heavier sediments when compared to the Inspection Ports.

### Manholes

Most systems will include at least two manholes - one at the inlet and another at the outlet. There may be more than one location where stormwater enters the system, which would result in additional manholes to inspect.

Bear in mind that these manholes often include a sump below the invert of the pipe connecting to the R-Tank. These sumps are designed to capture sediment before it reaches the R-Tank, and they should be kept clean to ensure they function properly. However, existence of sediment in the sump does **NOT** necessarily mean sediment has accumulated in the R-Tank.

After inspecting the bottom of the structure, use a mirror on a pole (or some other device) to check for sediment or debris in the pipe connecting to the R-Tank.

# R-TANK OPERATION INSPECTION & MAINTENANCE

If sediment or debris is observed in any of these structures, you should determine the depth of the material. This is typically accomplished with a stadia rod, but you should determine the best way to obtain the measurement.

All observations and measurements should be recorded on an Inspection Log kept on file. We've included a form you can use at the end of this guideline.

## Maintenance

The R-Tank System should be back-flushed once sediment accumulation has reached 6" or 15% of the total system height. Use the chart below as a guideline to determine the point at which maintenance is required on your system.

R-Tank Unit	Height	Max Sediment Dept
Mini	9.5"	1.5"
Single	17"	3"
Double	34"	5"
Triple	50"	6"
Quad	67"	6"
Pent	84"	6"

**Before any maintenance is performed on your system, be sure to plug the outlet pipe to prevent contamination of the adjacent systems.**

To back-flush the R-Tank, water is pumped into the system through the Maintenance Ports as rapidly as possible. Water should be pumped into ALL Maintenance Ports. The turbulent action of the water moving through the R-Tank will suspend sediments which may then be pumped out.

If your system includes an Outlet Structure, this will be the ideal location to pump contaminated water out of the system. However, removal of back-flush water may be accomplished through the Maintenance Ports, as well.

For systems with large footprints that would require extensive volumes of water to properly flush the system, you should consider performing your maintenance within 24 hours of a rain event. Stormwater entering the system will aid in the suspension of sediments and reduce the volume of water required to properly flush the system.

Once removed, sediment-laden water may be captured for disposal or pumped through a Dirtbag™ (if permitted by the locality).



2831 Cardwell Road  
Richmond, Virginia, 23234  
800.448.3636  
FAX 804.743.7779  
[acfenvironmental.com](http://acfenvironmental.com)

## **Step-By-Step Inspection & Maintenance Routine**

### **1) Inspection**

- a. Inspection Port
  - i. Remove Cap
  - ii. Use flashlight to detect sediment deposits
  - iii. If present, measure sediment depth with stadia rod
  - iv. Record results on Maintenance Log
  - v. Replace Cap
- b. Maintenance Port/s
  - i. Remove Cap
  - ii. Use flashlight to detect sediment deposits
  - iii. If present, measure sediment depth with stadia rod
  - iv. Record results on Maintenance Log
  - v. Replace Cap
  - vi. Repeat for ALL Maintenance Ports
- c. Adjacent Manholes
  - i. Remove Cover
  - ii. Use flashlight to detect sediment deposits
  - iii. If present, measure sediment depth with stadia rod, accounting for depth of sump (if present)
  - iv. Inspect pipes connecting to R-Tank
  - v. Record results on Maintenance Log
  - vi. Replace Cover
  - vii. Repeat for ALL Manholes that connect to the R-Tank

### **2) Maintenance**

- a. Plug system outlet to prevent discharge of back-flush water
- b. Determine best location to pump out back-flush water
- c. Remove Cap from Maintenance Port
- d. Pump water as rapidly as possible (without over-topping port) into system until at least 1" of water covers system bottom
- e. Replace Cap
- f. Repeat at ALL Maintenance Ports
- g. Pump out back-flush water to complete back-flushing
- h. Vacuum all adjacent structures and any other structures or stormwater pre-treatment systems that require attention
- i. Sediment-laden water may be captured for disposal or pumped through a Dirtbag™.
- j. Replace any remaining Caps or Covers
- k. Record the back-flushing event in your Maintenance Log with any relevant specifics



**Company Responsible:  
for Maintenance:**

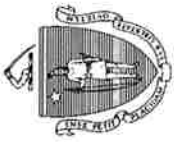
**Contact:** \_\_\_\_\_

**Phone Number:** \_\_\_\_\_

For more information about our products, contact Inside Sales at 800.448.3636 or email at [info@acfenv.com](mailto:info@acfenv.com)

## **A P P E N D I X F**

### **Soil Testing Results**



Commonwealth of Massachusetts  
City/Town of Wellesley

**Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal**

**A. Facility Information**

Wellesley Park, LLC

Owner Name

148 Weston Road

Street Address

Wellesley

City

MA

State

149 - 4

Map/Lot #

02482

Zip Code

**B. Site Information**

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair

2. Soil Survey Available? ☒ Yes ☐ No

If yes: Web Soil Survey

Source

254B

Soil Map Unit

Merrimac fine sandy loam

Soil Name

No major limitations for site development

Soil Limitations

Outwash

Geologic/Parent Material

3. Surficial Geological Report Available? ☒ Yes ☐ No

Landform

If yes:

1974

Year Published/Source

1:24,000

Publication Scale

Q1c4

Map Unit

4. Flood Rate Insurance Map

Above the 500-year flood boundary? ☒ Yes ☐ No  
If Yes, continue to #5.

Within the 100-year flood boundary? ☐ Yes ☒ No

5. Within a velocity zone? ☐ Yes ☒ No

6. Within a Mapped Wetland Area? ☐ Yes ☒ No

MassGIS Wetland Data Layer:

Wetland Type

7. Current Water Resource Conditions (USGS):

Jan. 2018

Month/Year

Range: ☐ Above Normal ☒ Normal ☐ Below Normal

8. Other references reviewed:



Commonwealth of Massachusetts  
City/Town of Wellesley

**Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal**

**C. On-Site Review** *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-1 Date: 1/31/18 Time: 8:30 AM Weather: Sunny 28 degrees

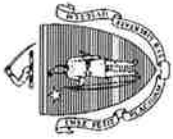
1. Location

Ground Elevation at Surface of Hole: 155.7 +/- feet Latitude/Longitude: 42 17'49.9" / 71 18'5.6"

Description of Location:

2. Land Use Vacant lot (e.g., woodland, agricultural field, vacant lot, etc.) Common Surface Stones (e.g., cobbles, stones, boulders, etc.) 3-5% Slope (%)  
Pine, oak, maple  
Vegetation  
3. Distances from: Open Water Body >100' feet Drainage Way >100' feet Wetlands >100' feet  
Property Line 40' +/- feet Drinking Water Well >100' feet Other  
4. Parent Material: Outwash Unsuitable Materials Present: Yes No

If Yes: Disturbed Soil Fill Material Impervious Layer(s) Weathered/Fractured Rock Bedrock  
5. Groundwater Observed: Yes No If yes: Depth Weeping from Pit Depth Standing Water in Hole  
Estimated Depth to High Groundwater: >100" inches <147.4 +/- elevation



Commonwealth of Massachusetts  
City/Town of Wellesley  
**Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal**

**C. On-Site Review (continued)**

Deep Observation Hole Number: TP-1

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"-56"	F					Fill					
56"-100"	C1	10YR4/6			0%	Sand	5-10%	<5%	Single grain	Loose	Medium

Additional Notes:



# Commonwealth of Massachusetts

City/Town of Wellesley

## Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

### C. On-Site Review (continued)

Deep Observation Hole Number: TP-2 Date: 1/31/18 Time: 9:15 AM Weather: Sunny 28 degrees

1. Location

Ground Elevation at Surface of Hole: 146.0 +/- feet Latitude/Longitude: 42 17'49.4" / 71 18'5.6"

2. Land Use  
Vacant lot  
(e.g., woodland, agricultural field, vacant lot, etc.)  
Pine, oak, maple  
Vegetation

Common  
Surface Stones (e.g., cobbles, stones, boulders, etc.)

3-5%  
Slope (%)

3. Distances from:  
Open Water Body >100' feet  
Property Line 20' +/- feet  
Outwash

Landform

Drainage Way

>100'  
feet

Position on Landscape (SU, SH, BS, FS, Wetlands  
>100'  
feet

Drinking Water Well >100'  
feet

Other  
>100'  
feet

4. Parent Material: Outwash Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: Depth Weeping from Pit Depth Standing Water in Hole

Estimated Depth to High Groundwater: >92" inches <138.3 +/- elevation



## Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

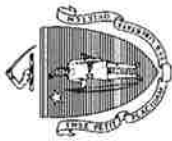
### C. On-Site Review (continued)

Deep Observation Hole Number: \_\_\_\_\_

TP-2

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"-20"	Ap	10YR3/2			0%	Sandy loam	5-10%	10%	Granular	Friable	
20"-32"	Bw	10YR4/6			0%	Sandy loam	10-15%	15%	Granular	Friable	
32"-92"	C1	2.5Y4/6			0%	Loamy sand	20-25%	20%	Single grain	Firm in place	Medium

Additional Notes:



## Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

### D. Determination of High Groundwater Elevation

1. Method Used:

- ☒ Depth observed standing water in observation hole
- ☐ Depth weeping from side of observation hole
- ☐ Depth to soil redoximorphic features (mottles)
- ☐ Depth to adjusted seasonal high groundwater ( $S_h$ ) (USGS methodology)

	Obs. Hole #TP-1	Obs. Hole #TP-2
	>100"	>92"
	inches	inches
	inches	inches
	inches	inches
	inches	inches

Index Well Number \_\_\_\_\_ Reading Date \_\_\_\_\_

$$S_h = S_c - [S_r \times (OW_c - OW_{max}) / OW_r]$$

Obs. Hole #	_____	$S_c$ _____	$S_r$ _____	$OW_c$ _____	$OW_{max}$ _____	$OW_r$ _____	$S_h$ _____
Obs. Hole #	_____	$S_c$ _____	$S_r$ _____	$OW_c$ _____	$OW_{max}$ _____	$OW_r$ _____	$S_h$ _____

### E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

- a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

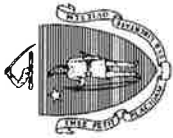
☐ Yes ☐ No

- b. If yes, at what depth was it observed?

Upper boundary: \_\_\_\_\_ inches  
Lower boundary: \_\_\_\_\_ inches

- c. If no, at what depth was impervious material observed?

Upper boundary: \_\_\_\_\_ inches  
Lower boundary: \_\_\_\_\_ inches



Commonwealth of Massachusetts  
City/Town of Wellesley

## Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

### F. Board of Health Witness

Name of Board of Health Witness

Board of Health

### G. Soil Evaluator Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Signature of Soil Evaluator

Alan W. Loomis, Soil Evaluator #1405

Typed or Printed Name of Soil Evaluator / License #

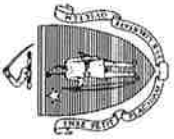
Jan. 31, 2018

Date

June 30, 2019

Expiration Date of License

**Note:** In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with [Percolation Test Form 12](#).

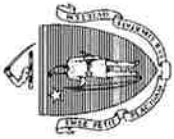


**Commonwealth of Massachusetts**  
City/Town of Wellesley

## **Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal**

### **Field Diagrams**

Use this sheet for field diagrams:



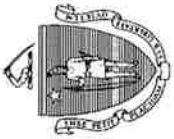
## Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

### A. Facility Information

Wellesley Park, LLC  
Owner Name  
148 Weston Road  
Street Address  
Wellesley  
City  
MA  
State  
149 - 4  
Map/Lot #  
02482  
Zip Code

### B. Site Information

- (Check one) ☒ New Construction ☐ Upgrade ☐ Repair
- Soil Survey Available? ☒ Yes ☐ No  
If yes: Web Soil Survey Source 254B  
Soil Map Unit  
Merrimac fine sandy loam  
No major limitations for site development  
Soil Limitations
- Geologic/Parent Material  
Outwash  
Surficial Geological Report Available? ☒ Yes ☐ No  
If yes: 1974  
Year Published/Source  
1:24,000  
Publication Scale  
Qlc4  
Map Unit
- Flood Rate Insurance Map  
Above the 500-year flood boundary? ☒ Yes ☐ No  
If Yes, continue to #5.  
Within a velocity zone? ☐ Yes ☒ No  
Within a Mapped Wetland Area? ☐ Yes ☒ No  
Current Water Resource Conditions (USGS):  
Range: ☐ Above Normal ☒ Normal ☐ Below Normal  
Jan. 2018  
Month/Year  
MassGIS Wetland Data Layer:  
Wetland Type
- Other references reviewed:



## Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

### C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-3 Date: 1/31/18 Time: 10:00 AM Weather: Sunny 28 degrees

1. Location

Ground Elevation at Surface of Hole: 146.9 +/- feet Latitude/Longitude: 42 17'49.1" / 71 18'6.0"

Description of Location:

2. Land Use Vacant lot  
(e.g., woodland, agricultural field, vacant lot, etc.)  
Pine, oak, maple  
Vegetation  
3. Distances from: Open Water Body >100' feet  
Property Line 20' +/- feet  
Outwash  
Landform Drainage Way >100' feet  
Drinking Water Well >100' feet  
Position on Landscape (SU, SH, BS, FS, TS) Wetlands >100' feet  
Other  
Common Surface Stones (e.g., cobbles, stones, boulders, etc.)  
3-5% Slope (%)  
4. Parent Material: Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock  
5. Groundwater Observed: ☐ Yes ☒ No If yes: Depth Weeping from Pit Depth Standing Water in Hole  
Estimated Depth to High Groundwater: >96" inches <138.9 +/- elevation



## Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

### C. On-Site Review (continued)

Deep Observation Hole Number: \_\_\_\_\_

TP-3

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"-8"	Ap	10YR3/2			0%	Sandy loam	10-15%	15%	Granular	Friable	
8"-15"	Bw	7.5YR3/4			0%	Sand	40%	20%	Single grain	Loose	Coarse
15"-38"	C1	10YR3/4			0%	Sand	40%	25%	Single grain	Loose	Coarse
38"-96"	C2	2.5Y4/4			0%	Loamy sand	25-30%	25%	Granular	Friable, firm in pl.	

Additional Notes:



Commonwealth of Massachusetts  
City/Town of Wellesley

## Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

### C. On-Site Review (continued)

Deep Observation Hole Number: TP-4 1/31/18 10:45 AM Sunny 30 degrees  
Date Time Weather

1. Location

Ground Elevation at Surface of Hole: 149.4 +/- 42 17'48.9" / 71 18'6.2"  
feet Latitude/Longitude:

2. Land Use Vacant lot Common 3-5%  
(e.g., woodland, agricultural field, vacant lot, etc.) Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)  
Pine, oak, maple

3. Distances from: Vegetation Landform Position on Landscape (SU, SH, BS, FS, Wetlands >100' feet)  
Open Water Body >100' feet Drainage Way >100' feet Wetlands >100' feet  
Property Line 20' +/- feet Drinking Water Well >100' feet Other >100' feet

4. Parent Material: Outwash Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: Depth Weeping from Pit Depth Standing Water in Hole

Estimated Depth to High Groundwater: >96" <141.4 +/- elevation  
inches



## Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

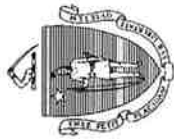
### C. On-Site Review (continued)

Deep Observation Hole Number: \_\_\_\_\_

TP-4

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"-2"	Ap	10YR3/2			0%	Sandy loam	10-15%	15%	Granular	Friable	
2"-22"	Bw	7.5YR3/4			0%	Sand	40%	20%	Single grain	Loose	Coarse
22"-36"	C1	10YR3/4			0%	Sand	40%	25%	Single grain	Loose	Coarse
36"-96"	C2	2.5Y4/4			0%	Loamy sand	25-30%	25%	Granular	Friable	Firm in place

Additional Notes:



## Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

### D. Determination of High Groundwater Elevation

1. Method Used:

- ☒ Depth observed standing water in observation hole
- ☐ Depth weeping from side of observation hole
- ☐ Depth to soil redoximorphic features (mottles)
- ☐ Depth to adjusted seasonal high groundwater ( $S_h$ ) (USGS methodology)

	Obs. Hole #TP-3	Obs. Hole #TP-4
	>96"	>96"
	inches	inches
	inches	inches
	inches	inches
	inches	inches

Index Well Number	Reading Date
-------------------	--------------

$$S_h = S_c - [S_r \times (OW_c - OW_{max})/OW_r]$$

Obs. Hole #	$S_c$	$S_r$	$OW_c$	$OW_{max}$	$OW_r$	$S_h$
Obs. Hole #	$S_c$	$S_r$	$OW_c$	$OW_{max}$	$OW_r$	$S_h$

### E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

- a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

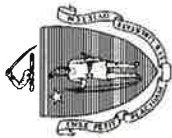
☐ Yes ☐ No

- b. If yes, at what depth was it observed?

Upper boundary: \_\_\_\_\_ inches  
Lower boundary: \_\_\_\_\_ inches

- c. If no, at what depth was impervious material observed?

Upper boundary: \_\_\_\_\_ inches  
Lower boundary: \_\_\_\_\_ inches



Commonwealth of Massachusetts  
City/Town of Wellesley

**Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal**

**F. Board of Health Witness**

Name of Board of Health Witness

Board of Health

**G. Soil Evaluator Certification**

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Signature of Soil Evaluator

Alan W. Loomis, Soil Evaluator #1405

Typed or Printed Name of Soil Evaluator / License #

Jan. 31, 2018

Date

June 30, 2019

Expiration Date of License

**Note:** In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with [Percolation Test Form 12](#).



**Commonwealth of Massachusetts**  
City/Town of Wellesley

## **Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal**

### **Field Diagrams**

Use this sheet for field diagrams:



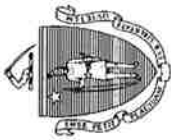
**Commonwealth of Massachusetts**  
**City/Town of Wellesley**  
**Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal**

**A. Facility Information**

Wellesley Park, LLC  
Owner Name  
148 Weston Road  
Street Address  
Wellesley  
City  
MA  
State  
149 - 4  
Map/Lot #  
02482  
Zip Code

**B. Site Information**

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair
2. Soil Survey Available? ☒ Yes ☐ No If yes: Web Soil Survey Source 254B Soil Map Unit
- Merrimac fine sandy loam  
Soil Name  
No major limitations for site development  
Soil Limitations
- Outwash  
Geologic/Parent Material
3. Surficial Geological Report Available? ☒ Yes ☐ No If yes: 1974 Year Published/Source 1:24,000 Publication Scale Qlc4 Map Unit
4. Flood Rate Insurance Map
- Above the 500-year flood boundary? ☒ Yes ☐ No Within the 100-year flood boundary? ☐ Yes ☒ No  
If Yes, continue to #5.
5. Within a velocity zone? ☐ Yes ☒ No
6. Within a Mapped Wetland Area? ☐ Yes ☒ No
7. Current Water Resource Conditions (USGS):  
Jan. 2018  
Month/Year  
MassGIS Wetland Data Layer:  
Range: ☐ Above Normal ☒ Normal ☐ Below Normal  
Wetland Type
8. Other references reviewed:



## Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

### C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-5      1/31/18      11:15 AM      Sunny 30 degrees  
Date      Time      Weather

1. Location

Ground Elevation at Surface of Hole: 157.2 +/-      Latitude/Longitude: 42 17'50.5" / 71 18'5.3"  
feet

Description of Location:

2. Land Use	Vacant lot	Common	1-3%
	(e.g., woodland, agricultural field, vacant lot, etc.)	Surface Stones (e.g., cobbles, stones, boulders, etc.)	Slope (%)
	Pine, oak, maple		
	Vegetation		
3. Distances from:		Landform	Position on Landscape (SU, SH, BS, FS, TS)
	Open Water Body	Drainage Way	>100'      Wetlands      >100'      feet
	Property Line	Drinking Water Well	>100'      Other      feet
	25' +/-      feet		
4. Parent Material:	Outwash	Unsuitable Materials Present:	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

If Yes: ☐ Disturbed Soil      ☐ Fill Material      ☐ Impervious Layer(s)      ☐ Weathered/Fractured Rock      ☐ Bedrock

5. Groundwater Observed: ☐ Yes      ☒ No      If yes:      Depth Weeping from Pit      Depth Standing Water in Hole

Estimated Depth to High Groundwater: >106"      <148.4 +/-      elevation

inches



## Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

### C. On-Site Review (continued)

Deep Observation Hole Number: \_\_\_\_\_

TP-5

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"-10"	Ap	10YR3/2			0%	Sandy loam	5-10%	<5%	Granular	Friable	
10"-24"	Bw	10YR4/6			0%	Sandy loam	5-10%	<5%	Granular	Friable	
24"-30"	C1	7.5YR4/6			0%	Sand	5-10%	<5%	Single grain	Loose	Medium- coarse
30"-106"	C2	2.5Y4/4			0%	Sand	5%	<5%	Single grain	Loose	Medium- coarse

Additional Notes:



Commonwealth of Massachusetts  
City/Town of Wellesley  
**Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal**

**C. On-Site Review** (continued)

Deep Observation Hole Number: TP-6 1/31/18 11:45 AM Sunny 30 degrees  
Date Time Weather

1. Location

Ground Elevation at Surface of Hole: 157.7 +/- 42 17'50.8" / 71 18'4.9"  
feet Latitude/Longitude:

2. Land Use Vacant lot Common 1-3%  
(e.g., woodland, agricultural field, vacant lot, etc.) Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)  
Pine, oak, maple

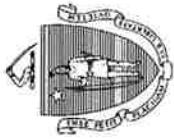
3. Distances from: Vegetation Landform  
Open Water Body Drainage Way >100' >100' Wetlands >100'  
feet feet feet  
Property Line Drinking Water Well >100' Other  
feet feet

4. Parent Material: Outwash Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: Depth Weeping from Pit Depth Standing Water in Hole

Estimated Depth to High Groundwater: >106" <148.9 +/-  
inches elevation



## Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

### C. On-Site Review (continued)

Deep Observation Hole Number: \_\_\_\_\_

TP-6

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"-27"	F					Fill					
27"-106"	C1	2.5Y4/4			0%	Sand	20-25%	15%	Single grain	Loose	Coarse

Additional Notes:



## Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

### D. Determination of High Groundwater Elevation

1. Method Used:

- ☒ Depth observed standing water in observation hole
- ☐ Depth weeping from side of observation hole
- ☐ Depth to soil redoximorphic features (mottles)
- ☐ Depth to adjusted seasonal high groundwater ( $S_h$ ) (USGS methodology)

	Obs. Hole # TP-5	Obs. Hole # TP-6
	>106" inches	>106" inches
	inches	inches
	inches	inches
	inches	inches

Index Well Number \_\_\_\_\_ Reading Date \_\_\_\_\_

$$S_h = S_c - [S_r \times (OW_c - OW_{max}) / OW_r]$$

Obs. Hole #	_____	$S_c$	_____	$S_r$	_____	$OW_c$	_____	$OW_{max}$	_____	$OW_r$	_____	$S_h$	_____
Obs. Hole #	_____	$S_c$	_____	$S_r$	_____	$OW_c$	_____	$OW_{max}$	_____	$OW_r$	_____	$S_h$	_____

### E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

- a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

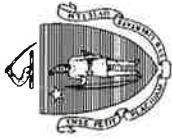
☐ Yes ☐ No

- b. If yes, at what depth was it observed?

Upper boundary: \_\_\_\_\_ inches  
Lower boundary: \_\_\_\_\_ inches

- c. If no, at what depth was impervious material observed?

Upper boundary: \_\_\_\_\_ inches  
Lower boundary: \_\_\_\_\_ inches



Commonwealth of Massachusetts  
City/Town of Wellesley

## Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

### F. Board of Health Witness

Name of Board of Health Witness

Board of Health

### G. Soil Evaluator Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Signature of Soil Evaluator

Alan W. Loomis, Soil Evaluator #1405

Typed or Printed Name of Soil Evaluator / License #

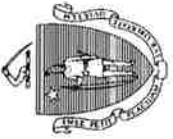
Jan. 31, 2018

Date

June 30, 2019

Expiration Date of License

**Note:** In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with [Percolation Test Form 12](#).



**Commonwealth of Massachusetts**  
**City/Town of Wellesley**

## **Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal**

### **Field Diagrams**

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Use this sheet for field diagrams:



Commonwealth of Massachusetts  
City/Town of Wellesley

## Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

### A. Facility Information

Wellesley Park, LLC

Owner Name

148 Weston Road

Street Address

Wellesley

City

MA

State

149 - 4

Map/Lot #

02482

Zip Code

### B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair

2. Soil Survey Available? ☒ Yes ☐ No

If yes: Web Soil Survey

Source

254B

Soil Map Unit

Merrimac fine sandy loam

Soil Name

No major limitations for site development

Soil Limitations

Outwash

Geologic/Parent Material

3. Surficial Geological Report Available? ☒ Yes ☐ No

Landform

If yes:

1974

Year Published/Source

1:24,000

Publication Scale

Qlc4

Map Unit

4. Flood Rate Insurance Map

Above the 500-year flood boundary? ☒ Yes ☐ No

If Yes, continue to #5.

Within the 100-year flood boundary? ☐ Yes ☒ No

5. Within a velocity zone? ☐ Yes ☒ No

6. Within a Mapped Wetland Area? ☐ Yes ☒ No

MassGIS Wetland Data Layer:

Wetland Type

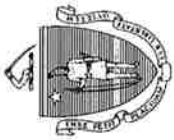
7. Current Water Resource Conditions (USGS):

Jan. 2018

Month/Year

Range: ☐ Above Normal ☒ Normal ☐ Below Normal

8. Other references reviewed:



Commonwealth of Massachusetts  
City/Town of Wellesley

**Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal**

**C. On-Site Review** *(minimum of two holes required at every proposed primary and reserve disposal area)*

**Deep Observation Hole Number:** TP-7      1/31/18      12:20 PM      Sunny 30 degrees  
Date      Time      Weather

1. Location

**Ground Elevation at Surface of Hole:** 158.1 +/-      Latitude/Longitude: 42 17'51.1" / 71 18'4.3"  
feet

**Description of Location:**

2. Land Use	Vacant lot (e.g., woodland, agricultural field, vacant lot, etc.)	Common Surface Stones (e.g., cobbles, stones, boulders, etc.)	1-3% Slope (%)
	Pine, oak, maple Vegetation		
3. Distances from:		Landform	Position on Landscape (SU, SH, BS, FS, TS)
	Open Water Body	Drainage Way	Wetlands
	Property Line	Drinking Water Well	Other
4. Parent Material:	Outwash	Unsuitable Materials Present:	
		<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	

If Yes: ☐ Disturbed Soil      ☐ Fill Material      ☐ Impervious Layer(s)      ☐ Weathered/Fractured Rock      ☐ Bedrock

5. Groundwater Observed: ☐ Yes      ☒ No      If yes:      Depth Weeping from Pit      Depth Standing Water in Hole

Estimated Depth to High Groundwater: >106"      <149.3 +/-      elevation  
inches



## Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

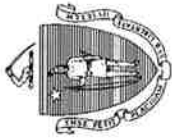
### C. On-Site Review (continued)

Deep Observation Hole Number: \_\_\_\_\_

TP-7

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"-26"	F					Fill					
26"-39"	Ap	10YR3/2			0%	Sandy loam	5-10%	<5%	Granular	Friable	
39"-66"	Bw	10YR4/6			0%	Sandy loam	5-10%	<5%	Granular	Friable	
66"-106"	C1	2.5Y4/4			0%	Sand	5-10%	<5%	Single grain	Loose	Medium- coarse

Additional Notes:



## Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

### C. On-Site Review (continued)

Deep Observation Hole Number: \_\_\_\_\_

Date \_\_\_\_\_ Time \_\_\_\_\_ Weather \_\_\_\_\_

1. Location

Ground Elevation at Surface of Hole: \_\_\_\_\_ feet  
Latitude/Longitude: \_\_\_\_\_ / \_\_\_\_\_

2. Land Use

(e.g., woodland, agricultural field, vacant lot, etc.) \_\_\_\_\_ Surface Stones (e.g., cobbles, stones, boulders, etc.) \_\_\_\_\_ Slope (%) \_\_\_\_\_

Vegetation \_\_\_\_\_

Landform \_\_\_\_\_

3. Distances from: \_\_\_\_\_  
Open Water Body \_\_\_\_\_ feet  
Drainage Way \_\_\_\_\_ feet  
Property Line \_\_\_\_\_ feet  
Drinking Water Well \_\_\_\_\_ feet  
Other \_\_\_\_\_ feet  
Position on Landscape (SU, SH, BS, FS, Wetlands) \_\_\_\_\_ feet

4. Parent Material: \_\_\_\_\_

Unsuitable Materials Present: ☐ Yes ☒ No

If Yes:

☐ Disturbed Soil

☐ Fill Material

☐ Impervious Layer(s)

☐ Weathered/Fractured Rock

☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No

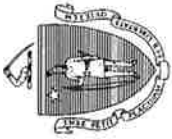
If yes:

Depth Weeping from Pit \_\_\_\_\_ Depth Standing Water in Hole \_\_\_\_\_

Estimated Depth to High Groundwater: \_\_\_\_\_

inches

elevation



## Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

### C. On-Site Review (continued)

Deep Observation Hole Number: \_\_\_\_\_

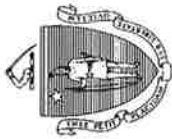
Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			

Additional Notes:

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## Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

### D. Determination of High Groundwater Elevation

1. Method Used:

- ☒ Depth observed standing water in observation hole
- ☐ Depth weeping from side of observation hole
- ☐ Depth to soil redoximorphic features (mottles)
- ☐ Depth to adjusted seasonal high groundwater ( $S_h$ ) (USGS methodology)

Obs. Hole # TP-7	Obs. Hole #
>106"	inches
inches	inches
inches	inches
inches	inches
inches	inches

Index Well Number	Reading Date
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$$S_h = S_c - [S_r \times (OW_c - OW_{max}) / OW_r]$$

Obs. Hole #	$S_c$	$S_r$	$OW_c$	$OW_{max}$	$OW_r$	$S_h$
Obs. Hole #	$S_c$	$S_r$	$OW_c$	$OW_{max}$	$OW_r$	$S_h$

### E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

- a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

☐ Yes ☐ No

- b. If yes, at what depth was it observed?

Upper boundary: inches Lower boundary: inches

- c. If no, at what depth was impervious material observed?

Upper boundary: inches Lower boundary: inches



Commonwealth of Massachusetts  
City/Town of Wellesley

**Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal**

**F. Board of Health Witness**

Name of Board of Health Witness

Board of Health

**G. Soil Evaluator Certification**

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Signature of Soil Evaluator

Alan W. Loomis, Soil Evaluator #1405

Typed or Printed Name of Soil Evaluator / License #

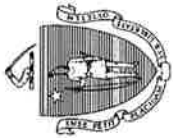
Jan. 31, 2018

Date

June 30, 2019

Expiration Date of License

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**Commonwealth of Massachusetts**  
City/Town of Wellesley

## **Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal**

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### **Field Diagrams**

Use this sheet for field diagrams: